SCIENTIFIC AMERICAN

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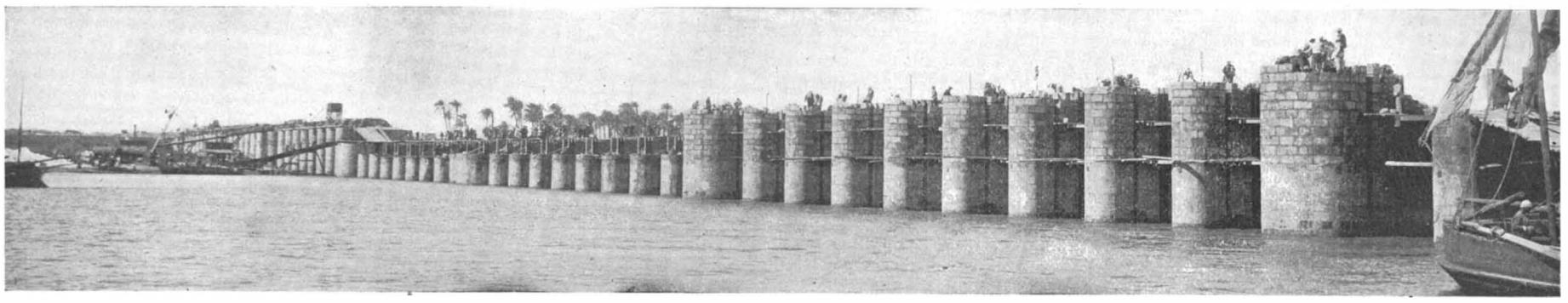
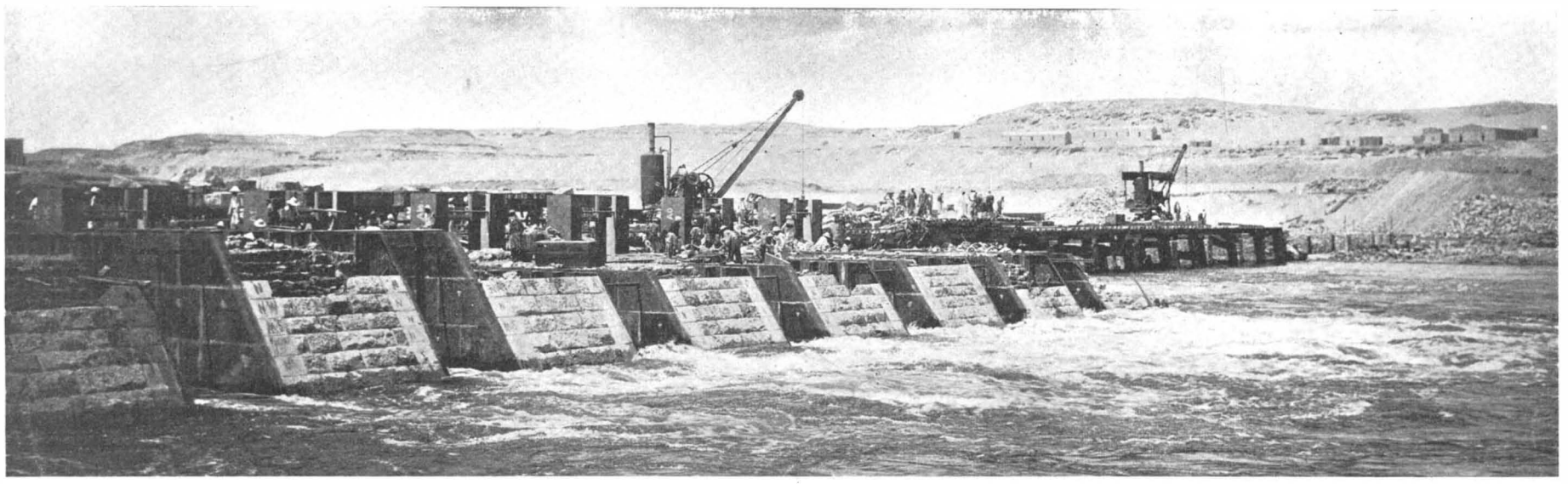
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

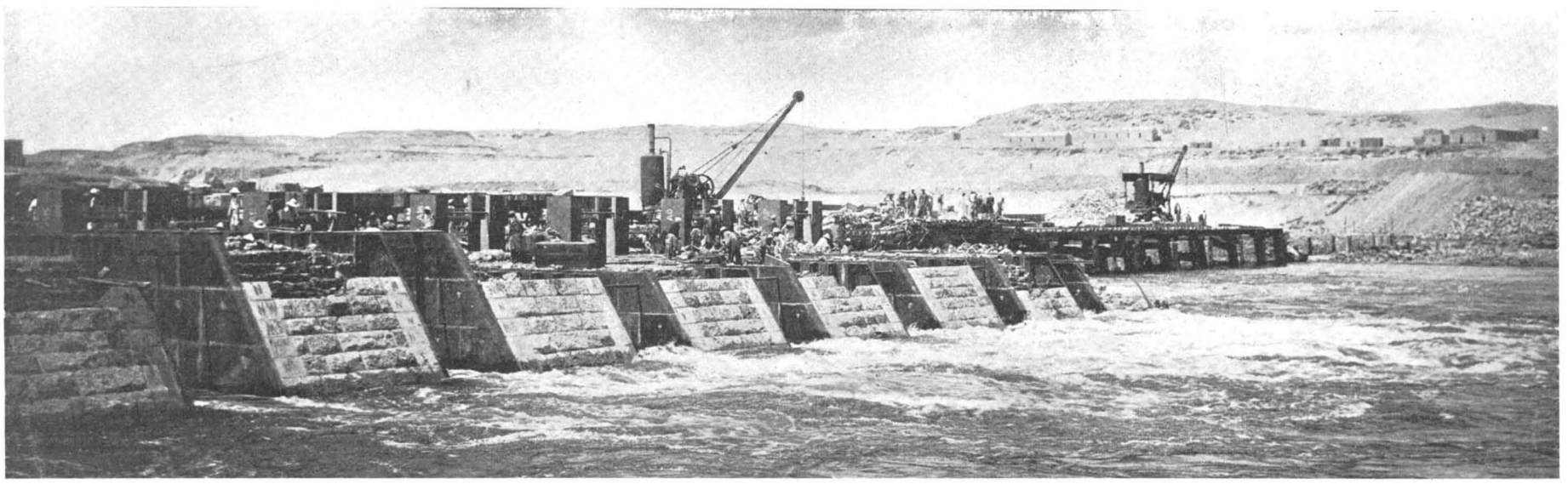
Vol. LXXXIV.—No. 18. ESTABLISHED 1845. | NEW YORK, MAY 4, 1901. | $3.00 A YEAR. 8 CENTS A COPY.



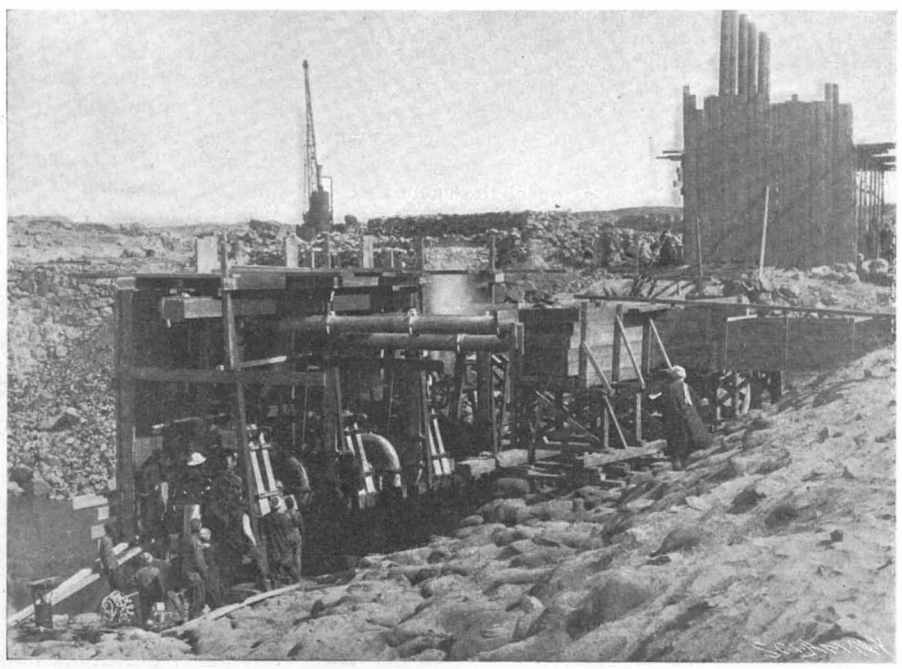
Nile Reservoir Works, Assiut—Upstream Side of Piers, Looking West.



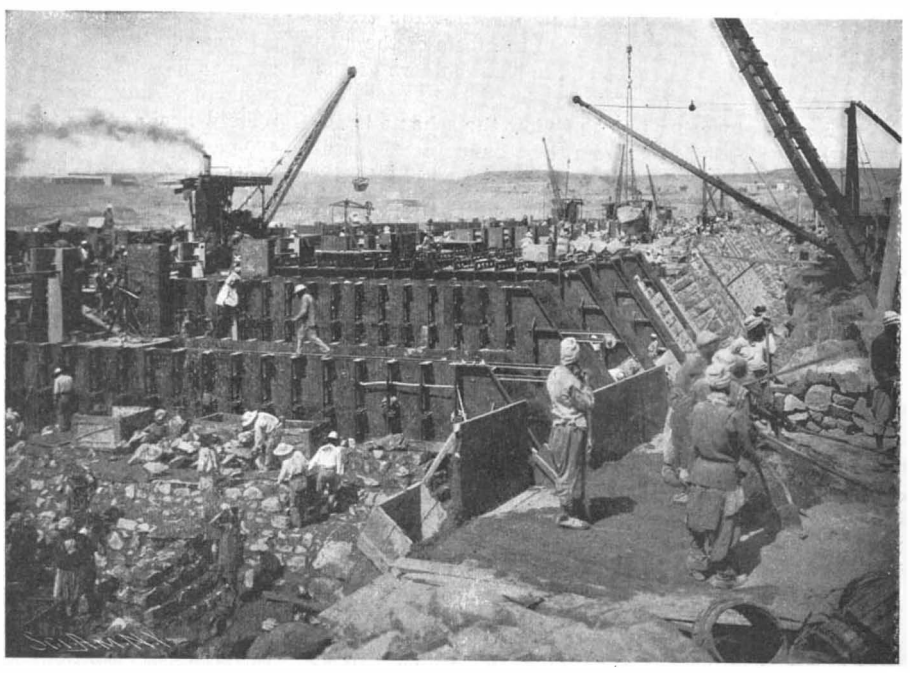
Assouan Dam—Water Rushing Through Central Sluices.



Work at the West Bank, Assiut.



Centrifugal Pumps at the Foundation Excavations.



Composite Metal and Masonry Construction, Assouan.

CONSTRUCTION OF THE GREAT NILE RESERVOIR.—[See page 279.]

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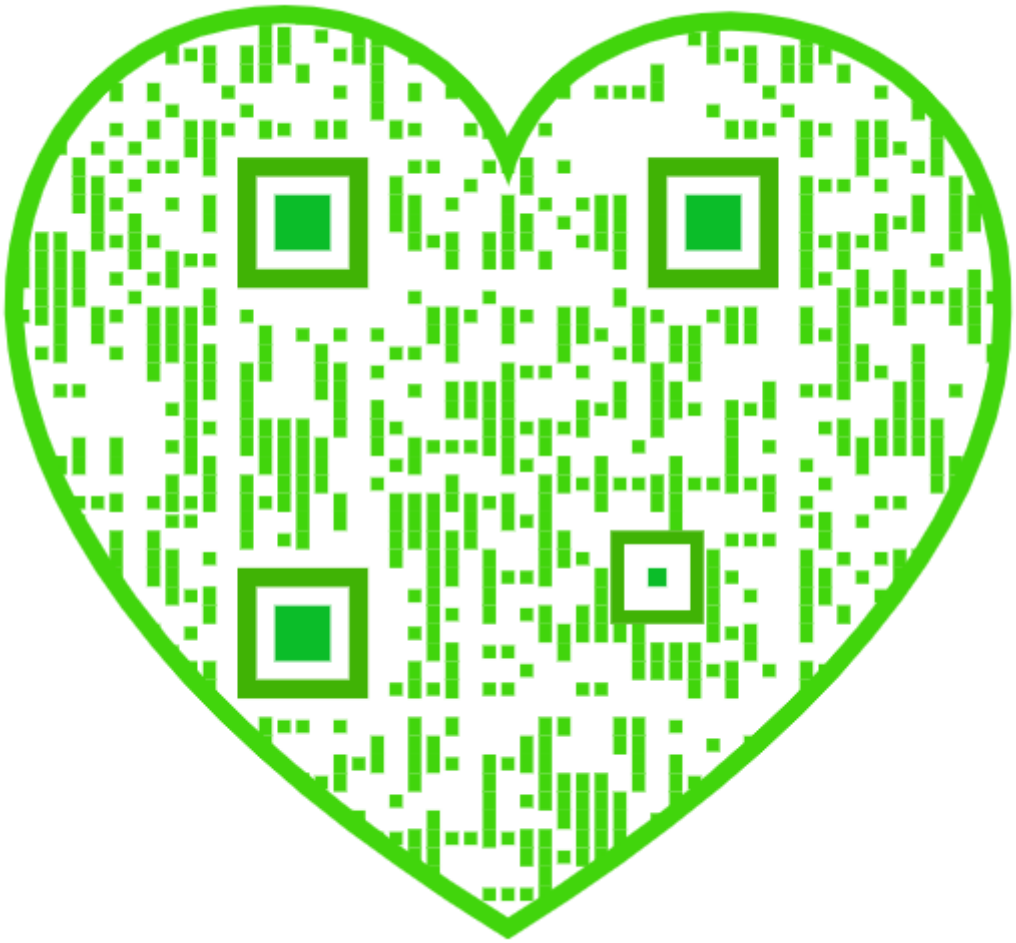

Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

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MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, MAY 4, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE NORTH RIVER BRIDGE BILL.

The storm of opposition, which has been aroused in New York by the passage of the North River bridge bill by the New York Legislature, is directed not against the bridge itself, nor even against the proposed elevated structure from Fifty-ninth Street to the Battery; for the erection of the bridge has come to be regarded as a necessity, and the extension of the bridge tracks along the Hudson River waterfront is admitted to be the necessary concomitant of the bridge itself. The present violent opposition is based upon the fact that, in giving to a private corporation the right to build an elevated structure along five miles of the city's waterfront, on the payment of a merely nominal consideration, the Legislature is practically handing over to private individuals property which, in the estimate of ex-Mayor Hewitt and the present Comptroller of the city, may easily prove to be worth from sixty to a hundred million dollars.

The North River Bridge should be built, and if private capital wishes to undertake such a gigantic scheme, it should be encouraged by all proper legislative assistance. To render the bridge effective, its tracks should certainly extend south from Fifty-ninth Street throughout the full length of the city's waterfront. But that any private corporation should be allowed to secure such a practical monopoly of ocean and river traffic as would result from the carrying out of the present bill, is not to be thought of for a moment. The present city government, the leading commercial bodies of the city, and the most prominent of its present and past officials, are unanimous in condemnation of the extraordinary audacity displayed in the present bill. If a franchise for the construction of the West Street line is to be granted, it should only be done subject to such conditions as are suggested by ex-Mayor Hewitt, namely, a rental equal to the interest, with a contribution to the sinking fund for the repurchase of the property within fifty years, and with the power of resumption by the city at any time during that period by paying the amount actually spent on the work plus a reasonable percentage. We are inclined to think, however, that in view of its enormous and ever-appreciating value, a railway of this kind giving access to all the docks, would develop such a vast earning capacity that the city could not do better than undertake the construction and ownership itself. The company that owned the combined bridge and approach would absolutely control the shipping situation in New York, and there would always be the temptation to operate the system on the vicious principle of charging up to the limit of what the traffic would bear, thereby sacrificing the interests of the city as a shipping point to those of the shareholders of the company.

From an engineering point of view the scheme is entirely feasible. Looked at from the standpoint of operation, moreover, there is everything to be said in its favor. The proposed bridge will have a capacity of six or eight main-line railroad tracks, and it will doubtless be capable of accommodating all the traffic from the West which now finds a terminus in Jersey City. Freight could be carried from any western shipping point, direct across the Hudson River, down the West Street elevated structure, and switched off, if need be, on to the steamer pier at which it was to be unloaded—an ideal traffic arrangement, and one to which New York city is bound ultimately to come, if it is to maintain its position as the chief shipping point on the Atlantic coast.

It is sincerely to be hoped that after Governor Odell has heard the committees from New York which are opposed to the bill and has looked at all the bearings of this momentous question, he will veto the measure and leave it for the bridge company and the city authorities to make an equitable arrangement which will be mutually profitable.

RE-ROLLING OLD STEEL RAILS.

During the past five years, there has been developed a method of utilizing old steel rails which bids fair to become an important factor in the steel industry. When steel rails were first introduced, the question arose as to what disposition could be made of them when they had been so far worn out as to be unfit for further service, and it was not until the introduction of open-hearth furnaces that it became possible to cut up the old rails and remelt them with pig iron and scrap from the stockyard.

About ten years ago Mr. W. E. McKenna, one of the officials of the Chicago, Milwaukee and St. Paul Railroad, turned his attention to the problem of utilizing these worn-down and defaced rails by re-rolling them to a size somewhat smaller than the original section. After considerable experimental work, the first of which was done in 1895, it was determined in 1897 to erect a plant for the special purpose of re-rolling old rails. The first plant was erected at Joliet, Ill., and in 1898 a second plant was built at Kansas City, Mo. At the present time over a thousand miles of track have been relaid with rails that have been passed through the re-rolling mills, a total of nearly one hundred thousand tons having been thus treated by the new system.

The wear upon the rails is, of course, chiefly on the top and inside of the head of the rail. In the process of re-rolling, the rails are very slightly reduced in the webs and flanges, while the contour of the head is restored to a symmetrical, though somewhat smaller section. Briefly stated, the process consists in first passing the rail beneath a set of grinders, which take off the slivers and rough edges from the head, then heating them in a special furnace to a temperature of 1,700 degrees, and rolling them down to the desired section, the rails passing out of the finishing rolls at a temperature of 1,480 degrees. The rails are then sawed to proper length, straightened, and the holes drilled for the angle bars.

The thorough working over of the metal at such a comparatively low temperature serves to improve its quality, not chemically, of course, but by virtue of the density and toughness which result from a thorough working over of steel and iron. The reduction of the section of the rail produces a corresponding elongation, a 30-foot rail being increased by 1 to 2 feet in length for a reduction of cross section of 8 per cent. The value of this system is obvious, particularly in view of the fact that theoretically the oftener a rail is re-rolled the better its quality. Since many of the great railroad systems use as many as three or four different weights of rail, according to the character of the traffic in different localities, it is evident that re-rolling will result in considerable economy, worn rails of a section being simply sent to the mills and rolled down to a section suitable to other divisions of the road.

NITRO-CELLULOSE VS. NITRO-GLYCERINE SMOKELESS POWDERS.

The facts brought out in an article by Lieut. A. T. Dawson, late of the Royal Navy, in a paper read before the English Society of Arts regarding the behavior of the British smokeless powder, cordite, are a decided indorsement of the wisdom of the Naval Ordnance Bureau in directing its attention to the development of pure nitro-cellulose, or all-gun-cotton, smokeless powder. Nitro-glycerine, on account of its great explosive energy, is an attractive ingredient in the manufacture of smokeless powder; but it has the great defect that the temperature of explosion is abnormally high and that the erosion of the interior surface of the gun is proportionately increased. The South African campaign has afforded an excellent opportunity to judge of the amount of this deterioration, and it is a fact that many field pieces in the Transvaal have been returned badly eroded, and that several of the 4.7-inch guns supplied from the navy were in constant need of replacing, the wear and tear of service having completely spoiled the shooting qualities. Variations of 400 yards in the range have been experienced with guns that had been some time in service and were badly eroded.

These results may be compared with those mentioned in the last report of Rear-Admiral O'Neil, in which it is stated that tests carried out by the Bureau of Ordnance with the navy nitro-cellulose powder prove that there is practically no erosion whatever, a 4-inch rapid-fire gun at the Indian Head Proving Ground having been fired 661 times, and a 5-inch gun 636 times, without causing any wear that could be detected by micrometer measurement.

Some of the nitro-cellulose powders used on the Continent have given ballistic results which entirely disprove the off repeated assertion that, weight for weight, cordite possesses much greater power than any nitro-cellulose compound. In a recent trial of a 45-caliber 6-inch gun, a charge of 28.6 pounds of cordite gave a velocity of 2,873 foot-seconds, while 36 pounds of Rottweil nitro-cellulose powder gave 2,910 foot-seconds. The corresponding energy for 2,910 foot-seconds is 5,872 foot-tons, whereas the velocity developed by the same gun in service, using cordite, is only 2,539 foot-seconds, equivalent to 4,438 foot-tons, or 32 per cent less energy. A further advantage of high velocity is the increased danger space, which in a 6-inch gun with 3,000 foot-seconds is 465 yards as against 226 yards in the case of the service 6-inch guns using cordite.

THE SMITHSONIAN REPORT.

Dr. S. P. Langley's report of the Smithsonian Institution for the year ending December 30, 1900, deals with the Institution proper, the United States National Museum, the Bureau of American Ethnology, the International Exchanges, the National Zoological Park and the Astrophysical Observatory. The total permanent fund now amounts to $912,000, and is deposited in the Treasury of the United States and bears interest at six per cent per annum, the interest alone being used in carrying out the aims of the Institution.

Congress charged the Institution during the fiscal year 1900 with the disbursement of $397,540, of which the National Museum received the greater part, although the grants of $75,000 to the National Zoological Park and $50,000 to the Bureau of American Ethnology may be regarded as a very satisfactory disposal of public funds. Appropriations made by Congress for the fiscal year 1901 were $428,540. The Institution has continued research work in various fields of science, including experiments in the solution of the problem of mechanical flight, and, through its Astrophysical Observatory, investigation on the solar spectrum. The Institution has made some interesting experiments during the year on "radio-active substances." The different branches of research now progressing under grants from the Hodgkins fund are making satisfactory advances. The income of the Hodgkins fund is devoted to investigations of the properties of atmospheric air. In accordance with the urgent desire of many of the leading biologists of the country a contract for a table in the Naples Zoological Station for a third term was entered into, and the appointments to the seats were at once approved. While it has never been possible for the Institution to devote a large amount of its income to carrying on explorations, it has, nevertheless, been able to promote such work in various ways, particularly in connection with the bureaus of the Institution and in co-operation with the executive departments of the government. These explorations have a very wide range, and are productive of a very great increase in the knowledge of natural history of the region visited, and of the ethnological conditions of the people. During the past year the Institution has thus been more or less directly concerned in explorations in various parts of the world, from the Arctic regions as far south as Patagonia, and in the distant possessions in the Philippines, as well as in South Africa.

Through the publications of the Institution and its bureaus much is done each year in carrying out its fundamental object, which is the "diffusing of knowledge." Works covering practically every branch of the human industries have been distributed throughout the world to librarians and institutions where they may best be available to scholars and to the reading public. The number of volumes, parts of volumes, pamphlets and charts given to the library has aggregated 25,701, and now only completed volumes are entered in the accession book. The secretary notes with regret the failure of Congress to make an appropriation to send a representative to the conference on the International Catalogue of Scientific Literature held in London.

Dr. Langley states that he is fitting up in the southern tower of the Smithsonian building a small room which is to be called the "Children's Room." The little group of specimens which it contains is meant to stimulate interest and imagination rather than to ostensibly instruct. Latin is banished from its labels, and the classification is not that of science but that which is most intelligible to the untrained minds. This room will, without doubt, prove very attractive to children and will probably be taken as a model the same as is the Children's Museum of the Brooklyn Institute, which we have illustrated.

The correspondence of the Institution embraces letters having reference not only to the scope and work of the Institution, but also relating to the bureaus placed by Congress under its direction. A part of $300,000 appropriated for a government exhibit at the Pan-American Exposition has been apportioned to the Smithsonian Institution and its bureaus. The collection will chiefly consist of specimens illustrative of its scientific functions and more especially of the National Museum and Bureau of Ethnology.

Robert Ridgway, Curator of Ornithology in the National Museum, published, a number of years ago for the use of the naturalist, a handbook on color, and he requested a grant from the Institution for a new edition. It appeared to the secretary that a work upon a more extended scale and a somewhat different plan would be of value, primarily to the naturalist,

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but also in every department of science, to artists and in many branches of industry. A committee has been appointed to consider the subject, as the work promises to be of considerable magnitude, and the results will be looked for with interest.

The Secretary calls attention to the necessity for an increase in the National Museum buildings, which are entirely inadequate. The field of the work of the corps of the Bureau of American Ethnology extended into Maine, New York, Minnesota, Wisconsin, Indian Territory, Oklahoma, California, Arizona, New Mexico, Cuba, Ontario and Nova Scotia, while especial work was done in other districts. The explorations and researches continue to yield valuable results in the form of contributions to the science of ethnology, while the collections made in connection with the work form an important tributary to the National Museum. Some practical importance attaches to the recent work of the bureau in connection with aboriginal agriculture and crop plants. The investigation of the wild-rice industry of the north lake region especially brings out a neglected phase of aboriginal industry and at the same time directs attention to a promising natural resource.

The free interchange of government and scientific publications between this country and the learned of other lands has grown to be one of the most important functions of the Smithsonian Institution. Great numbers of books are annually transported abroad and great quantities are received in exchange each year, the quantity handled aggregating 113,563 packages, weighing 409,991 pounds. The exchanges are in no sense of a commercial nature, for no publications for sale are allowed transmission. It is interesting to note that the expenses of the exchange service were for thirty years made entirely from the income of the Smithsonian Institution, but when public documents began to form so large a part of the transmissions as to become an unbearable strain on its resources, Congress began to make appropriations for the work.

The National Zoological Park is being constantly made more interesting by the introduction of new specimens. The extremely limited appropriations allowed by Congress have made it almost impossible to carry out the original programme of procuring a large collection of specimens of our native animals. The Astrophysical Observatory possesses a considerable quantity of apparatus which was employed in the observations on the solar eclipse of May 28, 1900, and we shall take pleasure in publishing in a subsequent number of our SUPPLEMENT full particulars of the work of observing the eclipse.

On the whole the Smithsonian Institution seems to be admirably administered with a view to carrying out the wishes of the original founder.

THE BALDWIN-ZIEGLER EXPEDITION TO FRANZ JOSEF LAND.

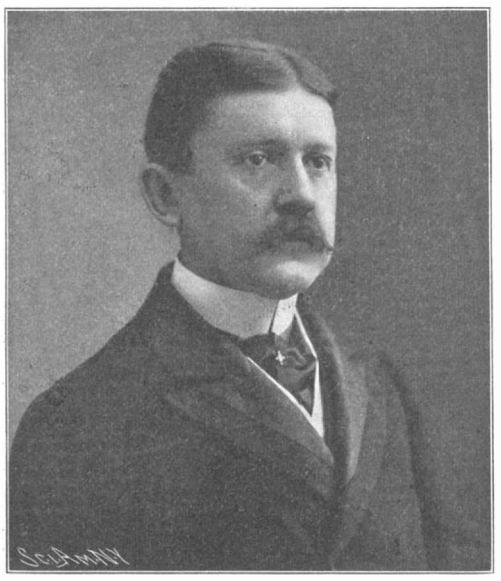
During the coming summer an expedition is to be sent to Franz Josef Land. It will be known as the Baldwin-Ziegler Expedition, and will be under the direct command of Mr. Evelyn B. Baldwin, formerly of the United States Weather Bureau. It is understood that the cost of the undertaking will be borne by Mr. William Ziegler, a wealthy and public-spirited resident of New York city. The principal objects of the expedition are to make magnetic, meteorological, gravity, and astronomical observations, in addition to surveying and hydrographic work, for which elaborate preparations are being made. It is also intended to make extensive collections of the flora and fauna of the region, as well as to gather specimens which will adequately represent the geographical formations.

The expedition will take two steam whalers and one or more steam launches, the latter being designed especially for use in shallow waters.

Franz Josef Land, once believed to be a continent and now known to consist of a group of islands, lies in the Arctic Ocean, north of Novaia Zemlia. It is in a higher latitude than any other known land in the eastern portion of the Polar Basin. It was discovered by an Austro-Hungarian expedition in 1873. The region was penetrated by a sledging party for a distance of about 125 miles. Payer, the commander of the land party, advanced up Austria Sound as far as Cape Fligely (82° 5′ north lat.) from which point—1,000 feet above the level of the sea—he observed mountains far away to the north, beyond the 83d degree. At this point it may be stated that Jackson, who visited the region later, found that no such land as Petermann Land existed. To the northwest high land rose above the open water. In the vicinity of the cape bears and foxes were plentiful, and seals were observed in large numbers about the edge of the ice. The abundance of animal life was most propitious for the explorers. Several eminent authorities regard this region as a most favorable starting-point for future journeys northward. Admiral Sir George Nares, of the British navy, went so far as to say that its extreme importance as a base for future operations has been proved. Admiral Albert Markham, in his recent work on Sir John Franklin, regards the region as "the objective from which future Arctic exploration should be carried out." Admiral Sir Erasmus Ommaney declared that "as all other points afford no hopes of penetration to the northward, we must now accept Franz Josef Land as the base for future operations;" and Sir Allen Young in like terms considers that it must be regarded as "the only land extending far to the north by which such journeys can be made."

The now celebrated Jackson-Harmsworth Expedition visited this land in 1894 and remained there for three years. While their object does not seem to have been to actually reach the North Pole, the hope was indulged that a thoroughly scientific exploration of Franz Josef Land might be made and that they might reach a point so far north as to afford facilities for a nearer approach to the North Pole than had hitherto been accomplished.

With the aid of his co-travelers Mr. Jackson found Franz Josef Land to consist of numerous islands instead of a continent, as had been previously believed. The idea of gaining a very high latitude was therefore abandoned, their special efforts being then devoted to a thorough examination of the group. Magnetic, meteorological and other observations were taken constantly and collections made in almost every branch of natural history. Winter quarters were established on Northbrook Island to the southwest of the group. Walruses, bears and seals were found in abundance. During the three years of their stay at the island the "Windward" paid a visit, but being frozen in, was compelled to remain a year. It returned with supplies in July, 1896. A month previous Dr. Nansen and Lieut. F. H. Johansen, who wintered in Franz Josef Land about 100 miles from Jackson, arrived at the island in their kyaks, and a cordial welcome was given them. In the following summer the "Windward" again



MR. EDWARD B. MOORE,
Assistant Commissioner of Patents.

visited Franz Josef Land, and on this occasion Jackson and his party returned home.

The collections which they made included rocks, fossils, silicified wood, plants, including phænogams, cryptogams, and lichens; eggs of snow bunting, eider duck, glaucous gull, kittiwake gull, ivory gull, Richardson's skua, Brünnich's guillemot, black guillemot and little auk; and birds, including the snow bunting, Lapland bunting, shore lark, common swallow, snowy owl, jerfalcon, Brent goose, eider duck, turnstone, Bonaparte's sandpiper, sanderling, Arctic tern, Ross' gull, glaucous gull, ivory gull, kittiwake, Richardson's skua, pomatorhine skua, Mandt's guillemot, little auk, Brünnich's guillemot, red-throated diver, and fulmar petrel. No traces of previous human occupation were found by the explorers.

Shortly before sailing from England in 1894 Mr. Jackson read a very interesting paper before the Royal Geographical Society of London, in which he summed up the advantages of the region for exploring purposes under these four principal heads:

"I. The accessibility of Franz Josef Land late in the summer when approached along the meridian of 45° E., or some meridian between that of 45° and 50° E. This accessibility has been proved, in my opinion, by the voyages of Mr. Leigh Smith and the little Dutch ship 'Wilhem Barents.'

"II. The northward extension of Franz Josef Land to a latitude as high as 82.5° at Cape Fligely, and some twenty or so miles further if we accept Payer's view that Cape Sherard Osborne is continuous with that portion of the country he called Prince Rodolf's Land. The long stretch of *terra firma* forms a safe route for advance or retreat, and provides all we need in the way of sites for our depots and cairns.

"III. The still further extension to the north of what, perhaps, I should call the Franz Josef Land group. Standing on Cape Fligely, Payer saw, sixty or seventy miles to the north, the high outlines of an ice-covered land of apparently large extent. This he called Petermann Land, and this land lies undoubtedly in a latitude as far north as any yet reached. There is absolutely nothing known of it beyond this, but it is a reasonable hypothesis to maintain that a land of such elevation would probably reach at least to the eighty-fourth degree north latitude, and who knows how much further?

"It is this land we shall try to reach after we have safely landed, and in the early days of the following spring marched over the ice of Austria Sound, a gulf which penetrates the country to Cape Fligely; or if this be not so favorable to us as it proved to Payer, along the shores that reach down to the Sound.

"IV. The fourth consideration is provided by the observations of Payer, confirmed by the winter experience of Mr. Leigh Smith. And this consideration is a strong one—the great abundance of animal life on the southern shores of Franz Josef Land during the winter as well as in the summer."

Although the results of exploring expeditions have always been hazardous subjects of speculation, it is confidently expected that the enterprise of the present year will be at least as successful as any that have yet been made in that region, while it is natural to hope that our American effort will eclipse all others in brilliancy of exploit and results of practical usefulness, and perhaps even pave a definite pathway to that long sought goal of explorers—the North Pole.

THE NEW ASSISTANT COMMISSIONER OF PATENTS.

The new Assistant Commissioner of Patents, vice Walter H. Chamberlain, resigned, is Mr. Edward B. Moore, late Principal Examiner of the Thirty-fifth Division of the Patent Office. Mr. Moore was born at Grand Rapids, Mich., and he entered the Patent Office some fifteen years ago and at once set himself resolutely to the task of fitting himself for promotion. Eleven years later he was appointed to the position of Principal Examiner and later made a Chief Examiner of the office. Mr. Moore was chosen to represent the Patent Office at the recent Paris Exposition. The Office made no formal exhibit on that occasion, but many interesting models were loaned for exhibition purposes. Mr. Moore has had under his supervision the examination of all cases relating to educational appliances, accouterments, baggage, advertising devices, bundle carriers, fluid pressure regulators, packing and storing vessels, buckles, buttons and clasps, constituting a very wide range of subjects and involving extended technical knowledge upon his part.

Mr. Moore is noted for the justice of his decisions, by which the interests of the inventor and those of the public are equally safeguarded. In his new office Mr. Moore will have an excellent opportunity of again demonstrating his fitness as to the general and technical requirements which are imperatively demanded for the effective performance of the difficult and responsible duties which devolve upon the Assistant Commissioner of Patents.

OPENING OF THE PAN-AMERICAN EXPOSITION.

The gates of the Pan-American Exposition were closed on April 21, and every available man was put to work in order to offset the damaging effects of the severe snowstorm which visited Buffalo. The damage to the buildings is very slight, but the delay in the landscape work and the building of roadways is a great hinderance. It was intended to have this portion of the work so complete that it would be possible to have the Fair practicallly complete on the opening day. The storm, however, was so severe that the managers decided to postpone the formal opening until Dedication Day on May 20. It is not intended to postpone the actual opening, but there will be no ceremonies until May 20. As the Fair will be very complete at that time and the weather will probably be better, the change seems to be a wise one. The first two weeks of every fair that has ever been held have seen incompleted buildings and empty exhibition spaces.

According to German press reports, the project involving the construction of an electric railway between Rome and Naples, which was agitated some time ago but afterward abandoned, has been revived. Two Neapolitan engineers, it is stated, have prepared new plans for the road, which have been submitted to the ministry of public works. The contemplated railway will run along the shore via Cancello, Mondragone, Minturno, Formia, Fondi, Terracina, and Cisterna to Rome, with a branch line, by way of Marano and Guigliano, to Capodimonti, the summer residence of the King. It will be double-tracked, with a total length of 135 miles.

A Swiss engineer named Sutter nearly lost his life while conducting some experiments with his airship at Arbon, near Lake Constance. His airship is similar to that of Count Zeppelin. The machine rose to a height of 150 feet, and then became unmanageable and fell.

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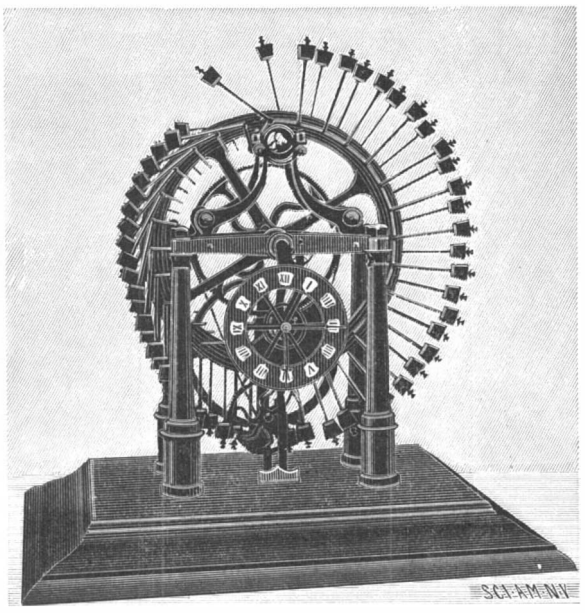
A PERPETUAL MOTION CLOCK.

At the Paris Exposition there was exhibited a clock which ran for two months without having to be wound up, therefore the makers were somewhat justified in calling it a "perpetual motion clock." The inventor obtained his result by combining a system of jointed levers or armatures with permanent magnets in order to permit the wheel to revolve indefinitely around its axis to coil a spring. The principle is based upon the fact that poles of the same name repel, while those of opposite names attract. Two series of movable levers are placed upon the faces of the rim of a large wheel. The two arms of such levers form between them an angle of forty-five degrees; the shorter one is provided at its extremity with a weight which acts as a counterpoise. The counterpoise most distant from the center has a preponderating action upon the side of the wheel. It makes four revolutions a minute, and actuates a regulating flywheel through the medium of an endless chain. The frame of the apparatus is constructed of magnetized steel. It supports the axle of the wheel and is surmounted by a roller that constitutes a pole. When in its motion the wheel brings the short arm of one of the levers opposite the roller, the phenomenon of repulsion is produced. We are indebted to La Vie Scientifique for our engraving.



A PERPETUAL MOTION CLOCK.

LAUNCH OF THE WHITE STAR LINER "CELTIC."

The launch at Belfast of the huge liner "Celtic" marks another great step of the rapid growth in size of the modern steamship. This truly gigantic vessel is easily the largest steamship ever constructed, for on her maximum draught of 36 feet 6 inches she will displace 37,700 tons, which is more than double that of the heaviest battleship afloat, and 10,300 tons more than that of the "Great Eastern." The next largest steamship is the "Oceanic." When they are completed, the big freighters under construction at New London, Conn., which, it is claimed, will be of 33,000 tons maximum displacement, will equal the "Oceanic" in size.

The "Celtic" is 700 feet long, her beam is 75 feet, and her depth 49 feet. She measures 20,880 tons gross, and 13,650 tons net. How these dimensions compare with those of other well-known liners is shown in the tabulated statement below. Gross tonnage is used in the table, and the lengths given are over all.

As will be observed, she is a few feet shorter than the "Oceanic," with, however, 7 feet more beam. She is, as the figures also show, the first vessel to exceed 20,000 tons. The task of building such a vessel was necessarily very heavy, and possibly there are not half a dozen shipbuilding yards in Great Britain which could have looked at it.

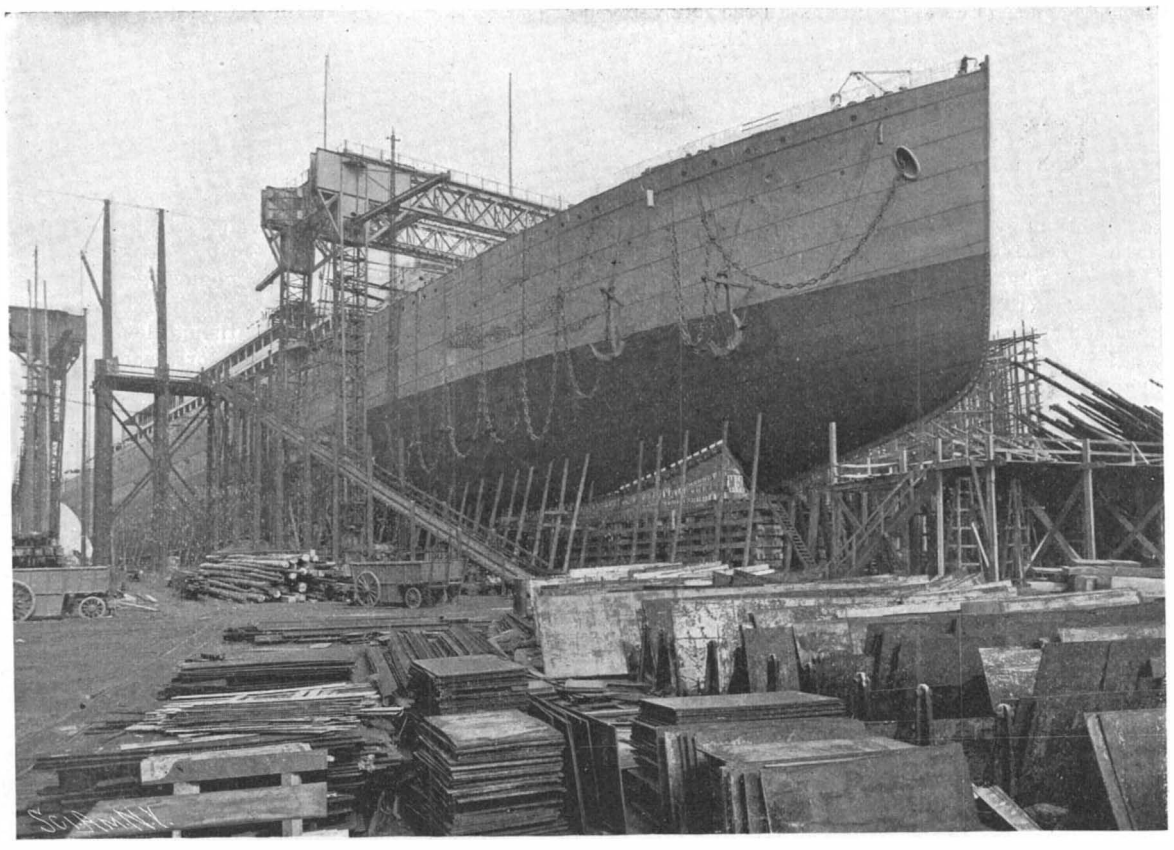
The shell plates of the "Celtic," of which there were 1,392, averaged 30 feet by 5 feet, were an inch and a quarter thick, and in some cases weighed as much as 4 tons. Machine riveting was adopted wherever possible in the keel, double bottom, hull, and stringers; 167,095 inch and quarter rivets were driven in this way.

There are altogether nine decks, and as their arrangement in some way facilitates the task of describing the vessel, the names may be given. They are—lower orlop, orlop, lower, middle, upper, bridge, upper bridge, boat, and sun decks. With obvious exceptions they are all real plated decks and of full length. The greatest care has been taken to secure her against the alternate hogging and sagging stresses she will experience. She has a flat bar keel riveted onto the skin plating and through riveted to the angle bars of the vertical inner keel. The rigidity is further increased by bilge keels which extend for about 250 feet, and for a considerable distance the bilge strake is doubled. The sheer strake and the next but one lower are also doubled and the upper deck stringers have been treated similarly except at the extreme ends. Strength fore and aft is further secured by six longitudinals worked intercostally, three on each side of the inner keel; with the thwartship vertical divisions these make the cellular double bottom, which is bounded by margin plates and covered by the inner skip plating. At the sides the frame brackets are attached to the margin plates by double angles, and the floor plates have been similarly treated. And to further increase the longitudinal stiffness there are two intercostal keelsons running fore and aft. At the decks, too, there is a beam to every frame, so that care could, to no greater extent, ensure a stoutly built ship. The arrangement for carrying the propellers is exactly that of the "Oceanic," and the rudder is of cast steel sections bolted together. The engines are of Harland & Wolff's quadruple expansion "balanced" type, with cylinders of 33, 47½, 68½, and 98 inches diameter. The stroke is 5 feet 3 inches. Steam will be supplied at a pressure of 210 pounds by eight double-ended boilers, each 15 feet 9 inches by 19 feet 6 inches. The vessel is not intended to be a record-breaker.

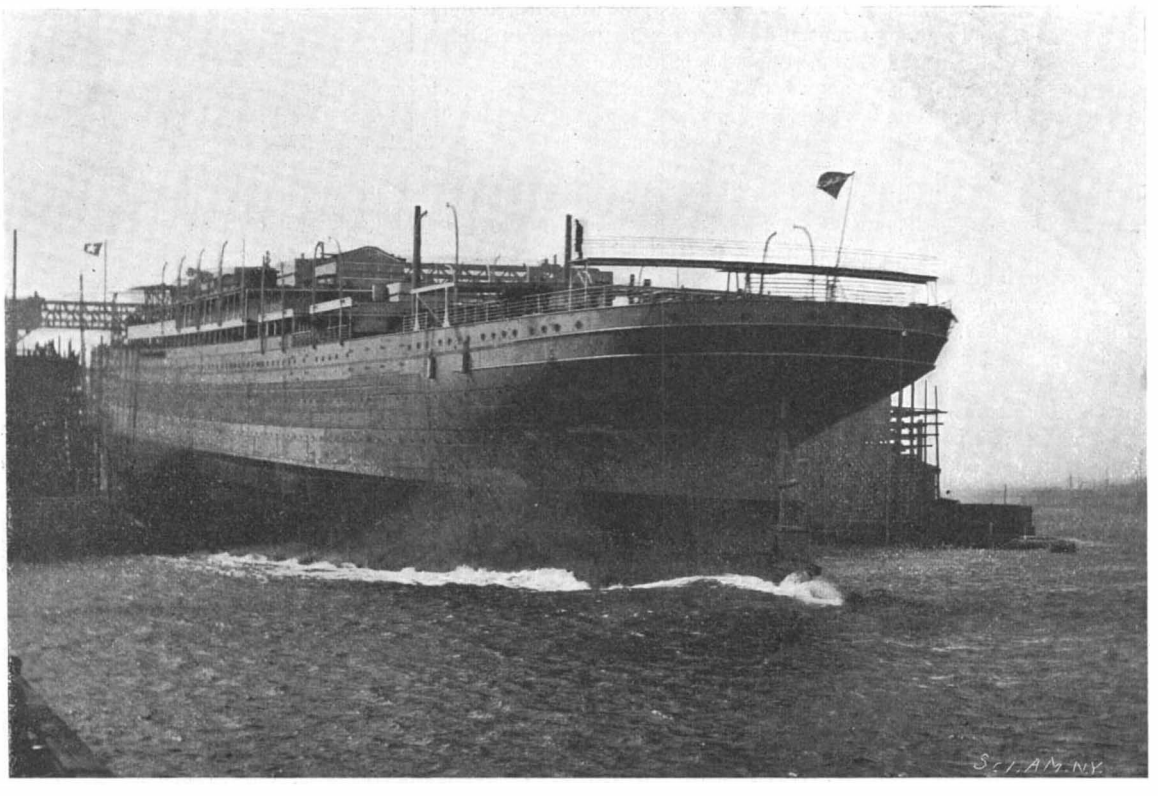
Vessel.	Length. Ft. In.	Breadth. Ft. In.	Depth. Ft. In.	Tons.
Great Eastern	691 0	82 8	48 2	18,915
Britannic	468 0	45 2	33 7	5,004
City of Rome	500 0	52 3	37 0	8,144
Alaska	520 0	50 0	38 0	6,400
Etruria	520 0	57 3	38 2	7,718
Paris	560 0	63 2	39 2	10,500
Teutonic	582 0	57 8	39 2	9,984
Fürst Bismarck	520 0	57 6	38 0	8,874
La Touraine	540 0	56 0	34 6	9,209
Campania	620 0	65 0	43 0	12,950
Kaiser Wilhelm der Grosse	648 0	66 0	43 0	14,349
Oceanic	705 6	68 0	49 0	17,274
Deutschland	686 0	67 0	40 4	15,500
Celtic	700 0	75 0	49 0	20,880

There are quarters for, altogether, 2,859 passengers and a crew of 335. The first class accommodation is on the upper, the bridge, the upper bridge, and the boat decks, and corresponds to that of the "Cymric." The number of first-class passengers provided for is 347. Aft on the upper and bridge decks there are quarters for 160 second-class passengers. Third-class passengers to the number of 2,352 are provided for on the upper, middle, and lower decks, some in staterooms and others in open berths.

The launching arrangements were those which worked so successfully in the floating of the "Oceanic," with the necessary difference for the greater weight that the chain was an eighth-of-an-inch thicker. The displacement of the hull was, it may be noted, no less than 13,500 tons. A massive steel casting, containing a hydraulic cylinder and ram, and a trigger half let in to a steel-shod niche in the sliding ways, was fixed in the standing ways. The lower half of the trigger was held in position by the ram until all was clear, and with the release of the pressure the upper half dropped flush with the ways. As the hull was water-borne its progress was checked by the dropping, pair after pair, of three pairs of anchors.



THE "CELTIC" ON THE STOCKS.



Length, 700 feet; **beam,** 75 feet; **depth,** 49 feet; **maximum displacement,** 37,700 tons; **Speed,** 16½ knots.

THE LAUNCH OF THE "CELTIC," THE LARGEST SHIP EVER CONSTRUCTED.

The official laboratory at Hamburg has discovered that the sand which fell during the recent snowstorm in southwestern Germany came from the African Sahara.

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French Wine Production of 1900.

The wine production of France for the year 1900 is 1,721,000,000 gallons, a yield that has only been exceeded three times in the past century. The promise of a large yield was so great in August that sales were made at less than a dollar per barrel for a good table wine. Of course, the high-grade wines brought large prices. Since early in the seventies up to 1900 there has been a great demand for American plants for grafting upon French vines. In 1881 the total area replanted with American vines was 21,262 acres; in 1889 it was 471,000 acres, and to-day it is 2,414,495 acres. The old vineyards which were destroyed by the phylloxera have been "reconstituted," as the French say, by graftings from the United States, and it is believed that they are now phylloxera-proof. The acreage planted in vines in France has been steadily increasing during the last twenty years, but there are reasons for believing that it has come to a standstill. The organs of the wine growers advise that attention be paid now to quality and not quantity. It is probable that the octroi tax will be abolished within a few months, and wine will enter the gates of all the cities of France duty free. It is hoped that this will have the effect of increasing the sale of wine and decreasing the consumption of alcoholic liquor. If the production of wine remains stationary more land will be devoted to the raising of early fruits and vegetables. The planting of mulberry trees and the raising of the silkworm will receive more attention. Wine is now produced more cheaply in California than in France, and the efforts to introduce French wines into Japan have not been effectual on account of Californian competition, the Japanese declaring they can buy wine cheaper in San Francisco than in France. The grape growers of France expect an absolute immunity from losses by hail by the use of cannon, and a newspaper which is the organ of the hail destroyers has just made its appearance.

Experiments have been carried on at Cape Town in which motors are used for transporting Maxim guns. The gun was mounted on a platform and occupied the front seat of a quadricycle.

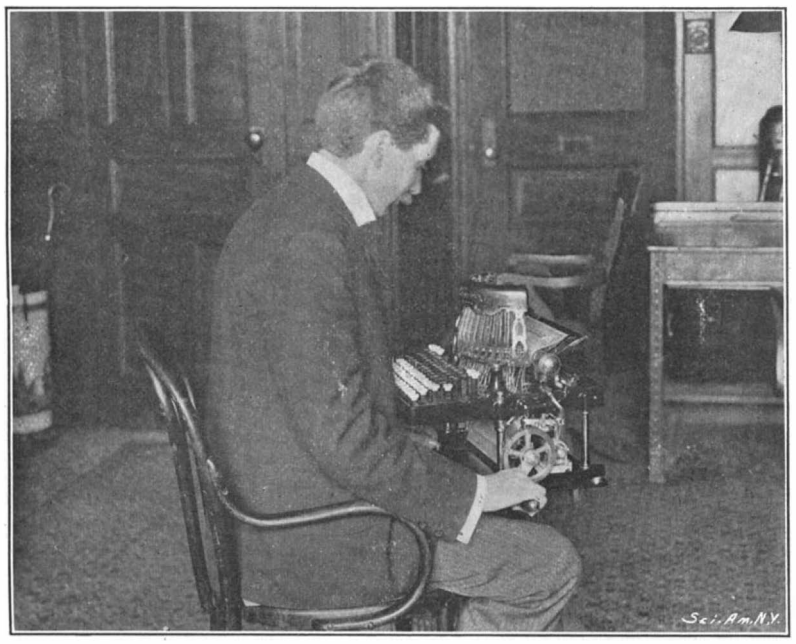
THE MURRAY PAGE-PRINTING TELEGRAPH.

The valuable invention which forms the subject of the present article is the work of a young Australian journalist; and it takes on particular interest from the fact that its author at the time he entered upon the investigation which has resulted so successfully was absolutely without knowledge of telegraphy. The earlier experiments were carried on in Sydney, and as soon as Mr. Murray had satisfied himself that his system was mechanically and operatively practical, he left at once for the United States for the purpose of securing his patents and introducing his system. His success has been thorough and rapid, for while his many applications for foreign patents were still pending, he made arrangements with the Postal Telegraph Company for the exclusive telegraphic rights to his invention in the United States.

Among the problems connected with telegraphy which have commanded the earnest efforts of inventors is that of automatically printing messages in the Roman characters. From time to time we have illustrated, either in the SCIENTIFIC AMERICAN or the SUPPLEMENT, the most successful inventions in this difficult but fascinating field of investigation. The demands of telegraphy are so various that it is not to be expected that any single printing telegraph can be produced that will answer for every class of telegraphic work, and all the machines of the kind that are in use, or proposed, belong to one or other of three or four types.

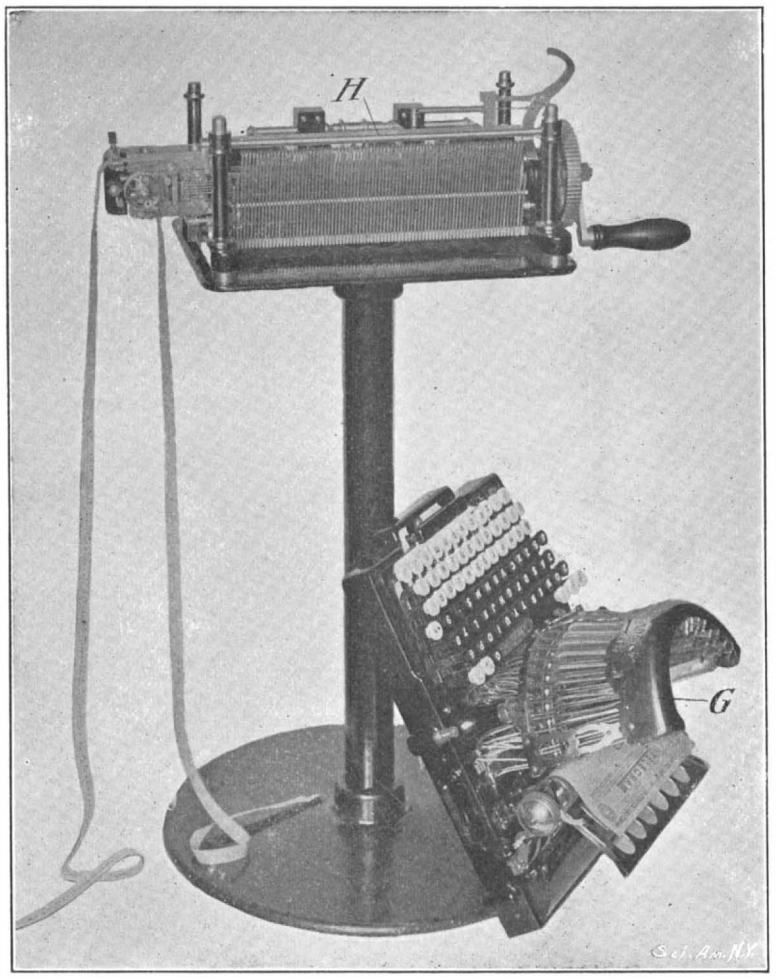
The simplest form of printing telegraph is the well-known "stock-ticker," the perfected form of which is found in the Burry page-printing telegraph, which was illustrated in the SCIENTIFIC AMERICAN of March 23, 1901. These machines, although they might be used in long-distance telegraphy, are designed more particularly for city use in the disseminating of news from a central station to a large number of separate private offices. Another class of printing telegraphs is that which is devoted mainly to long-distance telegraphy, as represented by the vast business of the leading telegraph companies, where speed and accuracy become of prime importance. It is only within the last year or two that efficient machines of this class have been perfected. One of these, invented by Donald Murray, is in use by the Postal Telegraph Company, and another, invented by Charles L. Buckingham, is being operated by the Western Union Company. In the same class are Rowland's and Baudot's multiplex-printing systems. Another class of telegraphy, to which belong the Delaney, the Squier and Crehore, and the Pollak-Virag, has not as yet established itself commercially; for with its speed of over a thousand words a minute, it is perhaps ahead of its time, since there is not sufficient telegraphic business of the kind required to keep such systems going at this enormous rate of speed.

It is impossible within the space at our disposal in the SCIENTIFIC AMERICAN to give a detailed description of Murray's most ingenious and successful telegraph. For this the reader is referred to a paper recently presented before the American Institute of Electrical Engineers, which is given in full in the SCIENTIFIC AMERICAN SUPPLEMENT of February 2 and February 9 of this year. The accompanying diagrams and photographs, however, show a complete installation, from the keyboard perforator at the sending station to the printer at the receiving station, and the subjoined description is sufficiently ample



Typewriter, with mechanical attachment, at the receiving station, on which, by the turning of a crank, the message is translated from the perforated characters on the tape to the printed characters on the page.

MR. MURRAY OPERATING A RECEIVING STATION PRINTER.



The typewriter, *G*, is removed to show the interlocking mechanism, *H*, by which the perforated characters on the tape are made to strike the keys of the Roman alphabet on the typewriter.

RECEIVING STATION PRINTER.

At the transmitting station the blank tape is punched with perforated characters in typewriter punching machine, *A*; then run through a modified Wheatstone transmitter, *B*. At the receiving station the impulses are controlled by relays, *C*, and a vibrator, *D*. and operate a punching magnet, *F*, which reproduces the perforated characters upon a blank tape. This tape is then run through an attachment, *H*, to a typewriter, *G*, which latter prints the message in page form in the Roman characters.

COMPLETE SET OF MURRAY PAGE-PRINTING TELEGRAPH APPARATUS—HIGHEST SPEED 130 WORDS PER MINUTE.

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to give a comprehensive idea of the principles and operation of the system.

The fundamental feature in the Murray system is the use of a perforated tape, which is divided lineally into exactly equal spaces of half an inch, each space representing a character. Each character-space is theoretically divided into five subdivisions, and the characters are determined by the number and sequence of the perforations in each letter-space. The perforated tape is run through a modified Wheatstone transmitter at the transmitting station, and the impulses, thus set up, serve to operate a magnetic perforator at the receiving station, which produces a facsimile of the transmitting tape by means of a punching magnet whose strokes correspond in frequency with the impulses received. The perforated tape produced at the receiving station is then run through a printer, whose operation is substantially the same as that of a pianola or automatic piano.

The punching machine, *A*, which in appearance is not unlike a typewriter, is so constructed that, as the tape is run through the machine, the striking of each key makes the proper combination of perforations in each half inch of character space. The prepared tape is ruled off into half-inch spaces and has a central line of fine perforations, which serves to engage the feed-wheels in the puncher and transmitter. There are ten small punchers, which are so arranged that five of them register on each side of the central line of perforations just referred to, and it can be easily understood that by the use of a system of interlocking bars the desired combination of punchers can be driven down at the stroke of each key. In all, 84 different characters may be punched.

As soon as a message has been punched by the operator, it is torn off by a boy who inserts it in a modified Wheatstone transmitter, *B*, which performs the functions of an ordinary telegraphic key. The tape is fed by means of an electrical pendulum-motor, driving a small star-wheel, which engages the central line of perforations and draws the tape through the machine. As the tape advances, the prickers, 4 and 5, which are located in line with the advancing lines of perforations in the tape, pass up through the perforations, and by their vertical oscillation give movement to reciprocating rods, 6 and 7, which serve to engage respectively with opposite terminals of a switch-arm, 8. The impulses thus set up are transmitted, let us say, from Chicago to New York, where they repeat, in sequence and frequency, the combinations of perforations in the tape. At the receiving station there is a main line relay, which governs a punching magnet in the perforator, *F*; also a governing relay, which maintains unison between the main-line impulses as they arrive and the corresponding impulses in the local circuit. This group of relays is indicated in our photograph by letter *C*. The local impulses are created by a vibrating reed (*D*, in photograph—11, diagram). The impulses as received at New York are utilized to perforate a blank tape which is a facsimile of the tape used in transmitting from Chicago.

The perforator, *F*, consists of a punching magnet and a spacing magnet. The tape is fed into the machine by a star-wheel (35, diagram) which is driven by a small motor; upon the same shaft as the star-wheel is an escapement controlled by the spacing magnet. The vibrating reed, 11, makes and breaks the local circuit of the spacing magnet. The impulses are so utilized, electrically, that the tape, as it leaves the machine exhibits perforations corresponding to those sent out from the Wheatstone transmitter at Chicago. The next operation is the important one of automatically transferring the perforated characters on the tape to a printing machine, which produces them in page form in the Roman characters. This is done by means of a typewriter, *G*, whose key levers are operated by an exceedingly ingenious combination of five transverse locking combs and a set of vertically-oscillating levers (41, in diagram; also *H*, in photograph). The combs terminate in five pointed rods, 40, the ends of the rods registering with five perforations in a plate, 38. The tape is caused to travel between the perforations in the plate and the pointed ends of the combs, the tape being drawn along a half-inch, or the length of one character, at each step. At the instant when the perforations of the tape coincide with the pointed ends of the bars, the plate is brought forward. Only those combs are moved longitudinally whose pointed ends correspond with the unperforated subdivisions of the tape, the other points projecting through the perforations in the tape and the die, and remaining stationary. Without pursuing the description any further, it can be seen at once, by reference to the diagrams, that the combinations thus formed of notches, 39, on the upper edge of the combs with the vertically oscillating strips, 41, above them, will result in the proper key lever from the typewriter above dropping into the clear groove thus formed. The moment it does this, a motor-driven cam engages it, produces a movement of the typewriter lever, and so prints the Roman character desired.

Such, in brief, is the system employed by Mr. Murray, and in the long-distance tests which have been made between Chicago and New York and Boston and New York a speed of 102 words per minute has been realized; and on a line 384 miles long, a speed of 125 words per minute. In the most recent working test by the Postal Telegraph Company a speed of 130 words per minute was attained. When the system is running at this latter speed twelve operators are required, six at each end; at lower speeds correspondingly fewer operators are needed. Although only one perforating machine is shown in our photographic view of the apparatus, there are three actually required to produce the perforated tape fast enough to match the full capacity of the system. Mr. Murray does not claim that there is any great saving of labor, but that there is an enormous saving of wire. The cost of a single copper wire from New York to Chicago is $60,000, and the system just described easily doubles and even trebles the capacity of the line. With regard to the increase in speed, it may be mentioned that the best Morse operators send fifty messages an hour, and as the messages average thirty words, this corresponds to a rate of twenty-five words a minute. As a matter of fact, fifteen words per minute is a fair average speed for a day's work. Working quadruplex it is good work for eight men, four at each end, to send a total of eighty words a minute; whereas by the Murray system it is possible to send 240 words per minute, or 120 words each way.

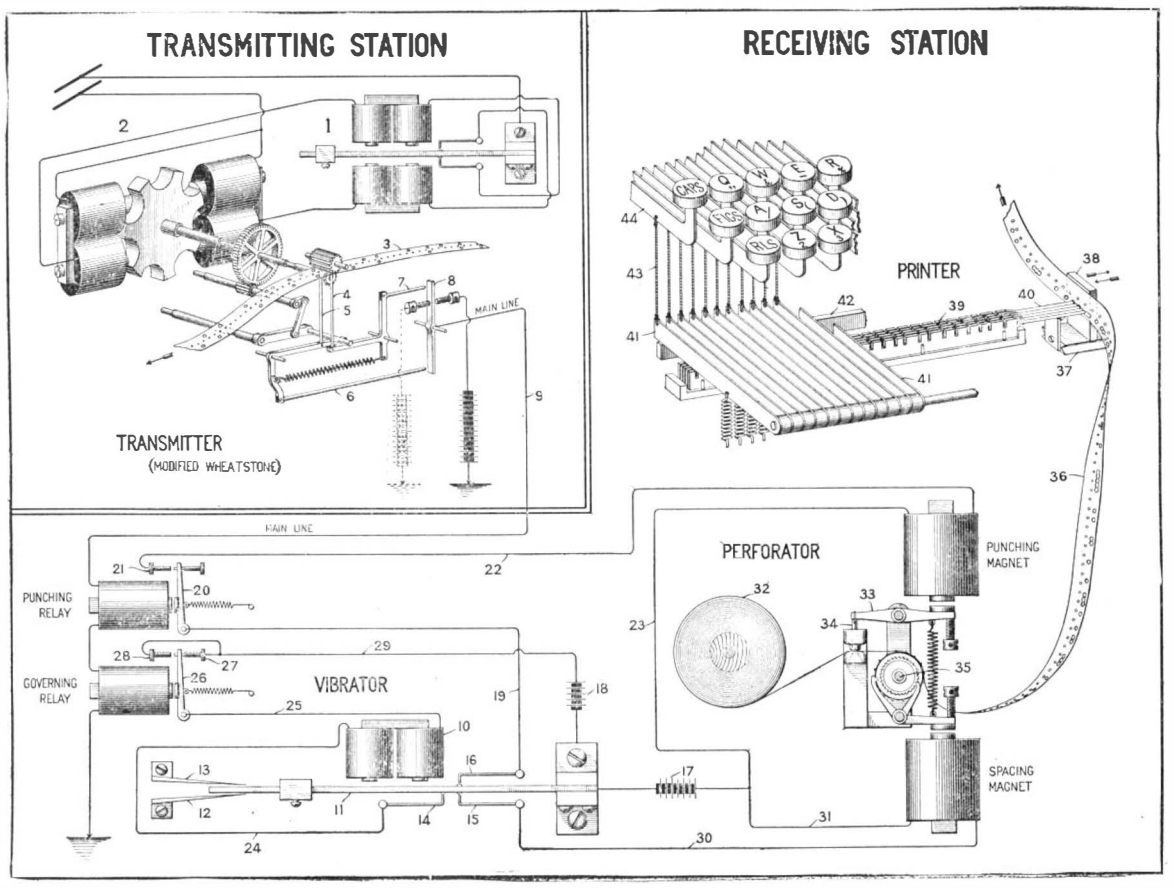

DIAGRAM OF PAGE-PRINTING TELEGRAPH APPARATUS.

The Havana Western Railway is trying to induce planters to begin cotton growing in the Island of Cuba. It has procured a quantity of seed from Egypt and the sea island plantations of Georgia and sections of Mississippi Valley, and is having a pamphlet printed in Spanish for distribution with the seed which is to be freely given out to planters or owners along the line who are willing to experiment with the fiber. If a sufficient number plant the seed the railroad will put up a cotton gin and all the necessary machinery for the convenience of growers at convenient points. Cotton was cultivated extensively in the district fifty years ago, and to-day cotton trees 20 feet high are to be found growing wild in many parts of the district, the fiber, however, being coarse and green.

Composition of Meteorite.

In a paper lately read before the Académie des Sciences, M. Stanislas Meunier gives an account of a chemical and mineralogical examination made upon a meteorite which fell at Lançon, in the south of France. The meteorite in question weighs about a pound and a half, and is of a light ash-gray, contrasting with the deep black of the surface layer which formed upon it during its traject through the air. Upon the body of the meteorite proper are seen a number of approximately parallel black lines which are only the outer edges of strata which traverse the mass. These strata have been formed at an early period under the influence of local heating and a resulting transformation of the rock, and are of the same character as the black surface layer recently formed by the heating of the rock due to air friction. The author finds that the density of the meteorite, taken in six portions weighing in all 50 grains, is 3.482 at 12 deg. C. He then analyzed it, first taking out the iron by means of the magnet. Of 30.8 grains which were finely pulverized in an agate mortar, the magnet took out 2.7 of iron in fine grains which were quite malleable, this being 8.8 per cent of the whole. In spite of their abundance in the mass, these grains are almost invisible on the breakage surfaces of the meteorite, but they appear very clearly when the surface is polished; under the microscope their forms are clearly seen, and these are quite remarkable. In the present case they are more compact than the granules observed in many other meteorites, and although ramified in form, they are less abundant in filaments and membraneous parts embracing the rock elements. Often they present angular profiles in some parts of their contours, which likens them to crystals, especially as the angles often approach 90 degrees. These grains are found to contain nickel in the proportion of 8.2 per cent. Before analyzing the rocky portion, some tests were made to separate it from the metallic minerals of a non-magnetic character. A notable quantity of combined sulphur was found in the course of the operation, for the fine dust, when acted upon by hydrochloric acid, disengaged a considerable amount of hydrogen sulphide. By a series of reactions, 6.35 per cent of pyrrhotine was found. In the present case this pyrrhotine is in the form of very fine grains and is distributed throughout the whole mass. Besides sulphate of iron, the rock contains small black grains which are visible in certain parts of it when viewed in thin sections; these grains, when separated, were found to consist almost exclusively of chrome iron, and its proportion is 0.54 per cent. As regards the stony or silicated part of the rock, a partial analysis was made by treating it with hydrochloric acid and thus separating it into a soluble and an insoluble part. The soluble part contained silica, manganese, iron and nickel, and is undoubtedly formed of peridot, especially as a microscopic examination of the rock in thin sections shows an abundance of this mineral in well characterized form. The insoluble part is more complex, and upon microscopic examination is considered to be a mixture of pyroxenic minerals, and especialy of enstatite with a small proportion of aluminous minerals (plagioclase). The final result shows the meteorite to be composed as follows: Iron (with nickel), 8.80 per cent; pyrrhotine, 6.35; chrome iron, 0.54; enstatite (with plagioclase), 52.21; peridot (by difference), 32.10 per cent.

An incandescent electric lamp with two independent filaments is being made in this country. One of these is to be used at ordinary times, while the other, which develops much less candle power, can be employed throughout the night. As a rule, these filaments are made to give 1 candle power and 16 candle power, respectively. The change over from one filament to the other is made by turning the lamp in a screw socket. The watts per candle power required by the small filament are much greater than those of the 16 candle power filament. On this account, the life of the small filament is said to be much more than the life of the 16-candle power one.

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THE NILE IRRIGATION WORKS.

One of the most beneficial effects of the English occupation of Egypt has been the attempt to restore the country to something approaching its former fruitfulness. Egypt is the Nile, and the Nile is Egypt. For several centuries this country, which during the reign of the Pharaohs was the most prosperous in the world, has remained over the greater part of its area a desert waste. When at the zenith of its power, the country was intersected in all directions with canals which irrigated the land; but in course of time the canals were filled up with the drifting sand from the desert and the country was abandoned.

The river Nile during its progress through lower Egypt gathers a vast quantity of rich sediment, which hitherto has been allowed to flow into the Mediterranean. It is estimated that billions of tons of this silt are thus wasted every year. The value of this alluvial soil alone may be estimated from the richness of the country at the Nile Delta. When Egypt was in the height of its prosperity, the Nile waters and silt were distributed over the desert, converting the sandy wastes into fertile fields.

The British government is endeavoring to resuscitate the country by storing the flood waters of the Nile and irrigating, once more, the desert lands. By this means Egypt will not only be in a position to produce sufficient cereals, cotton, etc., for her own exigencies, but will be able to supply the various markets of the world, since it will be possible to produce three crops in one season.

This conversion is being attained by the construction of large dams at different points on the river. Already two of these enormous structures are practically completed—one at Assouan and the other at Assiut. The idea is by no means modern, since a similar scheme was projected several years ago, and a tentative effort to realize it was made by some French engineers, by the construction of a dam near Cairo. This latter achievement, however, owing to the lack of care displayed in the erection of the barrier, and its instability, was practically a failure, and would have collapsed, flooding miles of the country, had it not been for the timely appearance of British engineers, who succeeded in strengthening the structure.

Egypt, however, although desperately requiring such a scheme to restore her country, owing to the lack of funds in the imperial exchequer would never have been in a position to have carried it out herself. The execution of the scheme originated with a syndicate of gentlemen in London, who propounded the idea to Sir Benjamin Baker, the well-known civil engineer, and Sir John Aird, the head of a large firm of contractors. The syndicate then approached Mr. Ernest Cassel, the well-known London financier, and he, together with Sir John Aird and Sir Benjamin Baker, hurried to Egypt, and laid their plans before the Egyptian government. After a short consultation the government approved the scheme and awarded the contract.

Surveys were then made of the river, to select the best spots at which to erect the dams. The river had previously been thoroughly surveyed by Major Willcocks, a well-known authority upon irrigation, so that the engineers were enabled to profit by the results of his work. Finally Assouan and Assiut were decided upon. Work was immediately commenced and has been continued day and night ever since. It was imperative that the work should be hurried forward with all possible speed, since when the Nile rose labor had to be stopped for several weeks, owing to the works being submerged.

The river at Assouan is over a mile in width, so that a fair estimate of the magnitude of the task may be made. The dam consists of a huge wall of granite. 60 feet in width at the top, 90 feet above low water, and a mile and a quarter in length, stretching across the river, from bank to bank. A roadway is to be constructed upon the top of the dam, which will afford a means of communication between both banks of the river. The dam is pierced by 180 huge steel sluices.

The erection of this barrier will impound over 1,000,000,000 tons of water, forming a lake which will extend up the valley of the Nile. When the sluice doors are opened while the Nile is at high water, something like 900,000 tons of water will rush through them every minute.

One effect of the construction of this dam will be the partial submersion of the historic temples of Philæ. When the scheme was originally projected, these ruins were to be entirely submerged, but an influential body of Egyptologists, headed by the late president of the British Academy, were successful in obtaining their partial preservation, so that now the ruins themselves will still be visible above high water.

The stone with which the dam has been built has been obtained from the same quarries which furnished the stone for the temples of Philæ and Cleopatra's Needle. Indeed, many of the granite blocks that have been excavated bear the marks of the Egyptian wedges that were utilized over thirty centuries ago. The work is being carried out under the supervision of English engineers, and some 25,000 natives are engaged upon the task, working in day and night shifts of 12,500 men each. During the night the work is carried on under electric light. The laborers receive about a dollar a week for their labor, together with board accommodations, which, although it may appear a ridiculously small wage, is yet about twice as much as is generally paid.

According to the terms of the contract no money is to be paid by the Egyptian government to the contractors until the task is completed. It is estimated that the undertaking will cost $25,000,000, and the settlement of the bill is to be spread over thirty years. The completion of the scheme will add 2,500 square miles to the crop-bearing area of Egypt, which, it is estimated, will be worth $400,000,000 to the country.

THE HEAVENS IN MAY.

BY HENRY NORRIS RUSSELL, PH.D.

The season of eclipses has once more come round, and two of them occur in the present month, being its most remarkable astronomical events.

The first is of little account, being indeed termed not a lunar eclipse, but a lunar appulse, for the reason that the moon does not pass into the earth's shadow at all, though it grazes it closely, and its nothern limb is considerably dimmed by the penumbra of the shadow. It takes place on the third and is invisible in America, but may be seen in Europe.

The second—the total solar eclipse of May 17—is a very notable one, and would doubtless be the most important one for many years, were it not for the unfortunate situation of the shadow-track, which crosses land for only a small fraction of its length, and that in rather inaccessible situations. Beginning in the Indian Ocean near the South African coast, it touches the southern end of Madagascar, passes over Mauritius, and after crossing several thousand miles of sea, falls on Sumatra and Borneo, crossing them almost exactly on the line of the equator, and moves eastward over Celebes, the Spice Islands and New Guinea, into the Pacific, where it leaves the earth.

The most favorable situations from which to observe the eclipse are on the coast of Sumatra, but unfortunately the weather conditions are bad, the chances being somewhat against clear skies at noon at this season —a poor showing compared with the ratio of six clear days to one bad one which held good for some American stations a year ago.

But the most remarkable feature of this eclipse, and the one which will cause astronomers to travel half way round the globe to see it, is its extraordinary long duration. While last year's eclipse, and the Indian eclipse of 1898, lasted at most about two minutes, the duration of totality on the present occasion is at maximum no less than 6 minutes and 26 seconds, which is longer than any that has ever been observed with modern instruments. This will add little to the importance of the phenomenon in the study of the lower layers of the sun's atmosphere, but will be of immense value for investigation of the corona, and also in the hunt for possible intra-Mercurial planets, since it enables photographic exposures of much greater length than usual to be made.

Since Americans who stay at home cannot see the eclipse, its interest for them must be chiefly theoretical; and in this connection, the question presents itself at once, "Why should this eclipse last so much longer than usual?" The principal reason is the moon's greater nearness to the earth, as we shall proceed to study in detail.

The orbit of the moon, like those of many other heavenly bodies, is decidedly eccentric, so that her distance from the earth varies by about 7 per cent on each side of the average value. Her apparent diameter is of course subject to corresponding variations, being greatest when she is nearest us. On the average it is 31′ 7″, but it may appear as great as 33′ 32″ or as small as 29′ 28″. The sun's apparent diameter is subject to similar changes due to the eccentricity of the earth's orbit about him. Its mean value is 32′ 4″, its greatest 32′ 36″ and its least 31′ 32″.

A clear understanding of the character of the different kinds of solar eclipses follows easily from the consideration of these figures. Suppose the observer to be so situated that the center of the moon appears exactly in front of that of the sun. If the moon is at her nearest she will appear larger in diameter than the sun, and will hide him completely, producing a total eclipse, while if she is at her farthest she will seem smaller than he does, so that a bright ring of uneclipsed sun will appear all round her, forming an annular eclipse. Since the average diameter of the moon is less than that of the sun, annular eclipses will evidently be more frequent in the long run than total ones.

The diameters of the sun and moon given above are those of these bodies as seen from the earth's center. But as a matter of fact they are observed from its surface, which must introduce certain modifications into our reasoning. If the observer is directly under the body he is 4,000 miles nearer it than he would be if at the earth's center, or if on any part of the earth where the body is just rising or setting. This makes no perceptible difference in the apparent size of the sun, since 4,000 miles is less than 1/20,000 part of his distance. But the case is not the same with the moon. When she is nearest she is but 220,000 miles away, and 4,000 miles is 1/55 part of this. Since she is 1/55 part nearer to the observer than to the earth's center she must look 1/55 part larger.

Referring to the above figures we find that her diameter will be increased by 36″, becoming 34′ 8″ as against 33′ 32″ as seen from the earth's center.

This augmentation of the moon's diameter increases the duration of a total eclipse, since the moon appears larger and extends farther beyond the sun's limb. It decreases the length of annular eclipses, because, since the moon seems larger, the width of the projecting rim of the sun is less. Its most remarkable result, however, is that the same eclipse may be total in one part of the earth and annular in another. Suppose, for example, that an eclipse occurs when the sun's diameter is 32′ 4″ and the moon's, as seen from the earth's center, is 31′ 50″. To an observer so situated that the moon is rising or setting, its apparent diameter will have this same value; and since the sun's is greater, he will see an annular eclipse, provided, of course, he is in the line of central eclipse. If, on the other hand, another observer, still on the line of central eclipse, has the sun—and moon—in his zenith, the moon will appear larger to him by 36″ than to the first observer, on account of the augmentation, and will have an apparent diameter of 32′ 26″, which is 22″ bigger than that of the sun, so that the eclipse for him will be total. On the 17th the sun's apparent diameter is 31′ 37″ and the moon's 33′12″. While the first is not quite at its minimum nor the second at its maximum this is much more nearly the case than usual, and to this circumstance the unusually long duration of totality is due.

THE HEAVENS.

We have nearly lost the winter constellations by this time. Only Auriga, the Twins and the lesser Dog-star remain, and they are so low in the west that we cannot hope to see them much longer.

Cassiopeia swings low beneath the pole, while the Great Bear is far up in the zenith above us. Draco is coming up on the eastward, almost surrounding the Little Bear with his starry coils. Cygnus is rising in the northeast, and Lyra is well up. Ophiuchus and Serpens occupy the eastern horizon, and Hercules, Corona, and Boötes extend upward nearly to the zenith, with the brilliant and ruddy Arcturus near the highest point. Of the zodiacal constellations, Leo and Virgo are conspicuous in the southwest and south. Cancer and Libra are visible on either side and Scorpio is rising in the southeast. Hydra occupies the lower southwestern sky, and low in the southeast and south are some moderately bright stars, which are all that we can ever see of the brilliant southern constellation Centaurus.

THE PLANETS.

Mercury is morning star till the 14th, when he passes behind the sun and becomes an evening star again. He can only be seen during the last few days of the month, when he sets nearly one and one-half hours later than the sun. At the time of the eclipse he will be visible close to the sun on the east, in a position singularly like that in which he was so conspicuous last May, but on the opposite side of the sun. Venus will be very close indeed to him. She is now an evening star, but will not be clearly visible in the twilight till the latter part of May. Mars is evening star, moving slowly eastward through Leo. He is in quadrature on the 28th, southing at 6 P.M. Jupiter rises about 1 A.M., Saturn about 1.15, and Uranus at about 11 P.M. in the middle of the month. The last named is in Scorpio, the other two in Sagittarius. Neptune is evening star in Taurus.

THE MOON.

Full moon occurs at the time of the lunar appulse on the afternoon of the 3d, last quarter on the forenoon of the 11th, new moon during the solar eclipse of the 17th, and so about midnight of our time, and first quarter at midnight on the 24th.

The moon is farthest from the earth on the 2d and again on the 29th, and is nearest early in the morning of the 17th, less than a day before the great eclipse. She is in conjunction with Uranus on the morning of the 6th, with Jupiter and Saturn on the afternoon of the 8th, with Mercury and Venus on the 17th, within a few minutes of each other and three hours after the eclipse, with Neptune on the morning of the 20th and with Mars on that of the 25th.

Armored Cruiser Discussion.

We are in receipt of another lengthy communication on the subject of our new armored cruisers, which will be found in the current issue of the SUPPLEMENT. Hereafter all correspondence on this subject will be transferred to the last-named publication.—Ed.

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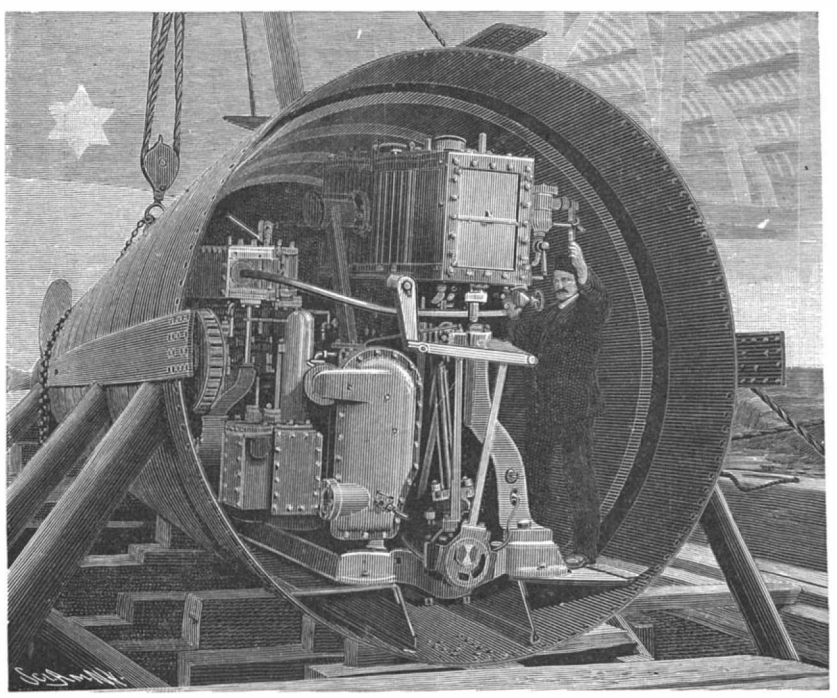
TURKISH SUBMARINE BOAT OF THE NORDENFELDT TYPE.

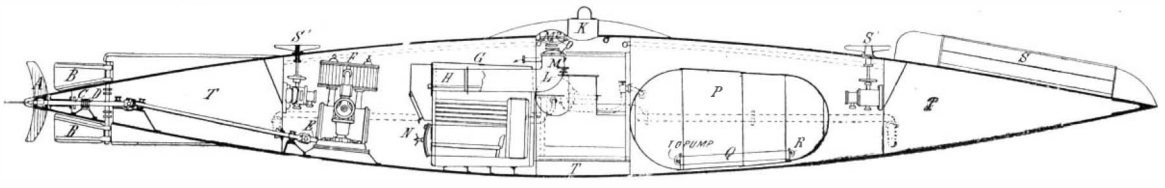
At the present time, when so much attention is being paid to the submarine boat, and several of this type are being constructed for our own navy, it is of interest to turn to an early series of experiments, carried out by the British Admiralty, which, in the opinion of our contemporary, The Engineer, to whom we are indebted for our illustrations, "has left them in such a position that there is practically nothing more to be learned on the subject from such experiments as France, going over very old ground, is now conducting."

Referring to the French experimental work now being carried on, the same authority says that between the year 1886 and September, 1888, a series of experiments in the construction and use of submarine boats was carried on in this country and abroad, beside which the French experiments now going on are mere child's play. Mr. Garrett, a gentleman in holy orders, and extremely ingenious, devoted the greater part of his life and fortune to the development of the submarine boat; and with him was associated Mr. Nordenfeldt, the inventor of the well-known Nordenfeldt gun. The vessel was designed to run near to the vessel to be attacked, then sink 20 feet below the surface, and proceed submerged to within striking distance, when she would discharge her torpedoes and return. For the purpose of propulsion steam was used in the ordinary way on the surface. When going to sink, the chimney was removed, and air-tight stopper fitted on the opening to the up-take. The furnace mouths were similarly closed by doors like those of a gas retort, and the boat sank. Power was then supplied on Lamm's system by the hot water in the boiler. The experimental boat quite realized all Mr. Garrett expected. A second boat was constructed, and after elaborate and prolonged experiments full of incident, the little vessel was bought by the Turkish government.



CROSS-SECTION OF TURKISH SUBMARINE BOAT.

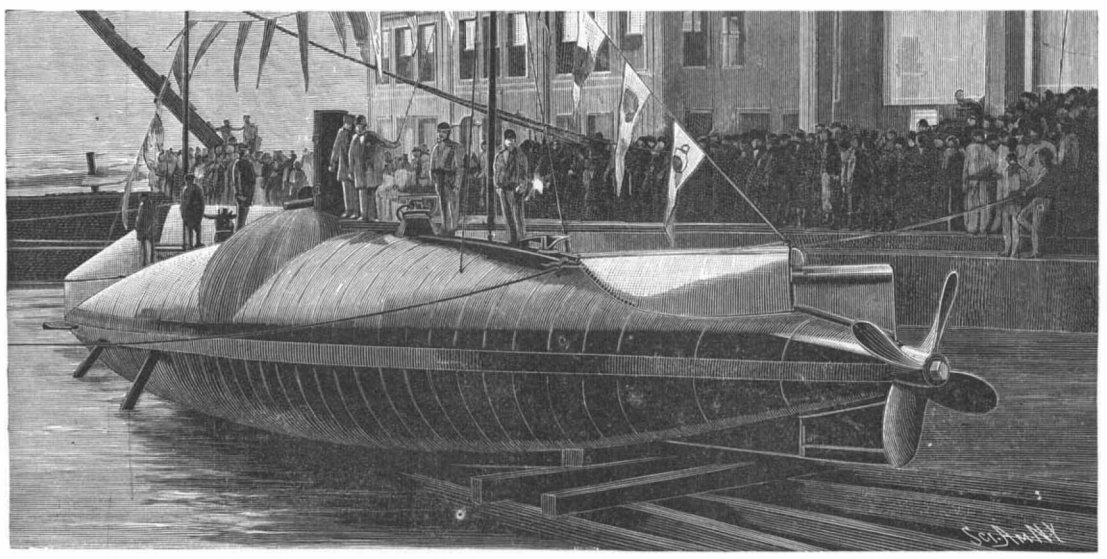
The accompanying illustrations show two sectional views and a view from the quarters of one of the Turkish boats, whose description and principal dimensions, as given in The Engineer, are as follows: Length 100 feet, beam 12 feet, and displacement 160 tons. The engines are of the ordinary surface-condensing compound type, with two cylinders, and are estimated to indicate, at a pressure of 100 pounds of steam, 250 horse power. There is nothing particularly to remark about these engines, except that the circulating and air pumps are worked by a separate cylinder. The main engine is thus left free to work or not, while vacuum is always maintained to assist the various other engines with which the boat is fitted. The boiler, marked *G* in the longitudinal section, is of the ordinary marine return-tube type. It has two furnaces, and the heating surface is about 750 square feet. A novel feature about it is, however, that after the products of combustion have passed through the tubes, they again pass through a large pipe, marked *H*, in the steam space of the boiler before they reach the funnel. The object of this is threefold: First, the economy of heat and fuel; secondly, to enable the funnel to be as near the center of the boat as possible, and thirdly, that the inboard portion of the same might be kept the cooler by thus lengthening the passage to it of the heated air. The hot-water cistern is seen at *P*, and the power to operate all the separate engines during a submarine voyage is the heat, as previously mentioned, which is stored up in its contents, as also in those of the boiler. In all there are some 30 tons of water, the vapor of which has a maximum tension of 150 pounds per square inch when the boat is first submerged; and this, with the assistance of the vacuum, is sufficient to drive her from thirty to forty miles without lighting any fire on board or using any air for the generation of heat. The pressure is raised in the hot-water cistern as follows: Live steam from the boiler enters a series of tubes which have a superficial area, in all, of some 500 square feet, and after parting with its latent heat to the contents of the cistern, being then in the aqueous form, is taken off by a small double-acting pump and carried back to the boiler. The propeller, *A*, is placed abaft the rudder, *B*, and it will be noticed that although the shaft is central, working on the thrust-block, *D*, the coupling connecting the crankshaft of the engine, *E*, is placed low down in the boat. It is this feature in the arrangement which admits of the use of a marine engine of ordinary type. The engines which operate the vertically-acting screws are of the three-cylinder type. This is in order that there may be no dead center, as it is highly important that they should start the moment steam is turned on. By the use of a special valve the captain is enabled to vary the speed of the propellers and to stop them both together or separately, at will, and thus to arrange the depth at which his craft is to operate. As seen in the engraving, these propellers in the Turkish boats are placed in the fore-and-aft line.



VERTICAL LONGITUDINAL SECTION.

The maintaining of the vessel in a horizontal position is controlled by two bow-fins. By a very ingenious arrangement of a plumb-weight, with other mechanism extending to the conning-tower, the action of these fins is rendered both automatic and controllable, and perfect command is thus insured over the movements of the boats, as far as the vertical plane is concerned. To touch now upon the manner in which the "Nordenfeldt" is operated, it should be understood that the boat has two distinct conditions of existence as a torpedo craft—that of a surface boat, and a submarine one. When performing the functions of a surface boat, the air which is sucked into the boat through the conning tower, *K*, by the fan, *L*, is forced by the said fan into the engine-room. From here, having no other outlet, it passes into the furnaces, and after supporting combustion reaches the atmosphere by way of the tube, *H*, as previously described, and the funnel. The connecting link between the inner and outer portions of the funnel, *M* and M^1, is not seen, it should be mentioned, in the engraving. In this position, with more or less of her bulk immersed, as may be thought necessary, according to the nature of the service upon which she is engaged, the boat can proceed upon voyages only limited in extent by her coal-carrying capacity. This in the Turkish boat is estimated to suffice for the fuel to drive her 900 knots at a moderate speed. The immersion of the boat in her surface condition is regulated by the admission or otherwise of water into the ballast tanks. Of these there are three, one at each end and a third under the center compartment, *T T T*, in the engraving. The two first mentioned contain about fifteen tons of water each, and the central one seven, when the boat is at her proper draught for descending. At this draught there is very little of the craft visible beyond the conning tower, and knowing even in which direction to look, it is not an easy matter to make her out at any great distance, the eye being unassisted by the ear on account of the noiselessness of the engines. All those who have witnessed the running of the boat here have been particularly struck with this feature of her performance, as also the little disturbance at the surface occasioned by the screw.

Before the boat can assume her condition as a submarine craft, it is necessary to hermetically close the furnaces, which is done by the doors marked *N*, upon which combustion is soon brought to an end. The piece of funnel connecting the boiler with the outboard portion is then removed, and the doors, *O* and O^1, placed in position, as shown in the engraving. While these changes are being effected, water is allowed to run into the ballast tanks, to reduce the buoyancy to its proper limit, and this arrived at, nothing remains but to close up the conning tower. The vertically-acting screws may then be set in motion to place the boat quite out of sight, or she may proceed with nothing but the glass cupola of the conning tower showing above the surface.



SUBMARINE BOAT IN DOCK AT CONSTANTINOPLE.

SIBERIA IN THE GLACIAL AGE.

Prof. G. Frederick Wright, of Oberlin College, recently returned from a trip around the world made in the interests of the science of geology. The main object of the trip was to settle, if possible, what has long been a disputed question among geologists—that is, whether Siberia has ever been covered with ice as North America and parts of Europe were during the glacial period. The view which is generally accepted is that Siberia was covered with ice, and a great many geologists still hold this view.

As a result of his trip Prof. Wright believes that at the time when North America was covered with ice, Siberia was covered with water. He found no signs of glacial phenomena south of the fifty-sixth degree. North of that he did not go, but he is convinced that the land was never covered by ice as was our own. According to The New York Sun, Prof. Wright says:

"We did find indications of an extensive subsidence of all that region, which puts a new light on everything here. At Trebizond, on the south shore of the Black Sea, there was evidence of a depression of 700 feet. This was shown by gravel deposits on the hills. In the center of Turkestan the waters reached their greatest height, for there we found these deposits over 2,000 feet above sea-level. Southern Russia is covered with the same black earth deposit that we found in Turkestan. There were still other evidences of the waters having covered this portion of the globe. One of these is the presence yet of seals in Lake Baikal, in Siberia, 1,600 feet above sea-level. The seals which we found are of the Arctic species, and are the same species as found in the Caspian Sea.

"The only theory, therefore, is that they were caught there when the waters receded. Perhaps the most wonderful discovery of all was at the town of Kief, on the Nippur River, where stone implements were found fifty-three feet below the black earth deposit, showing that the water came there after the age of man. This enabled us, therefore, to determine the

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age of this depression. It shows that since man came there there has been a depression of 750 feet at Trebizond, and in southern Turkestan the waters were over 2,000 feet deep. The implements found were such as those made in North America before the glacial period, which gives good ground for believing that the depression was made there when the glacial avalanche occurred here. In short, it was practically the Flood."

Prof. Wright made some interesting investigations on the Red Sea. He states that it has hitherto been supposed that the Children of Israel crossed the Red Sea at Suez, but it has been found difficult to reconcile this supposition with the fact that a million persons crossed the sea in a single night, which would necessitate a very wide division of the waters. His explorations north of Suez have convinced him and those to whom he talked that the point of crossing was twenty miles north of Suez, because at that point the conditions are all fulfilled. The waters at that time were about four feet in depth there, and the mountains are in the west, just as related, and an east wind would have swept bare a place at least five miles wide.

HOFMAN'S FLYING MACHINE.

Following hard upon the heels of the Viennese engineer, Wilhelm Kress, whose aeroplane has been illustrated and described in the SCIENTIFIC AMERICAN, comes a Berlin inventor, Regierungsrath J. Hofman, who has constructed what is claimed to be a working model of a flying-machine. Kress, for lack of funds, was severely hampered in building his device. Unable to purchase a motor—an obstacle which, we are glad to note, has been overcome with the assistance of the Emperor of Austria—Kress could test his contrivance only on water. Hofman, on the other hand, did not immediately proceed with the building of a full-sized machine, but has first constructed a model on a scale of 1 to 10.

To start and to land are the most difficult feats in operating a flying-machine. For this reason ingenious inventors, among them Prof. Langley, have erected special frames from which they start their machines in order to secure sufficient living force, the machines themselves being merely of sufficient strength to meet the requirements of the speed to be attained. Hofman's machine differs materially from the contrivances of these inventors, in so far as he uses no particular launching-frame or other construction. He employs legs which are provided with wheels at their lower ends, and which are normally in the position shown in Fig. 2, but which are suddenly drawn from the ground close to the body when the propellers are set in motion. Robbed of its support, the machine falls, driven forward by its propellers. But the machine drops barely a second; beneath the wings, projecting far out from each side, sufficient air has collected to sustain the entire apparatus. New masses of air continually collect beneath the wings, so that, it is claimed, the buoyant force of the air becomes so great that the machine is not only supported in its flight, but is even driven further upward, there to be maintained at the desired height by the action of its propellers.

The little steam-engine used to drive the propellers is supplied with steam at a pressure of 165 pounds by a boiler composed of 72 water-tubes. The engine itself is made of steel. For a full-sized flying-machine, Hofman intends to use coal as fuel, although the firing of the boiler with petroleum has also been contemplated.

The wing or sail surfaces have an area of over 21 feet, and project laterally to a distance of 4.66 feet. The entire weight of the little model is 7.7 pounds.

The Scientific Alliance of New York city is now actively engaged in raising funds for a building to be devoted to the scientific societies of New York. It is desired to obtain $500,000.

The White Rhinoceros.

A few individuals of the white rhinoceros, *Rhinoceros simus*, are to be found in Natal and Zululand, but their number is very small; it is supposed that not more than twenty of these animals exist in the world. Not long ago a band of five individuals was seen by a party among whom was the Governor of Natal. This was in one of the regions set apart as a game preserve, near the junction of the White and Black Umfolzi. The governor and a local functionary were told that a band of these animals was to be seen; both proceeded in the direction indicated, on horseback, and soon came in sight of the band. The animals were moving slowly toward a clump of bushes and allowed themselves to be approached, not seeming at all shy; the horsemen came within 150 feet of the enormous animals, who were occupied in feeding upon the grass of the plain, near some scattered trees. As they did not seem to be alarmed, the two men dismounted and approached on foot, stopping at a distance of only 60 feet from the group. They were thus enabled to observe the animals very closely for more than a minute; the latter did not seem to pay any attention to them, but kept on grazing. Soon, however, they commenced to sniff the air and became unquiet, but without apparently seeing their visitors, who were not at all concealed, and then commenced to move off slowly, first walking, then at a trot. It is a rare circumstance to see and to observe these animals for any length of time at such close quarters. The group was composed of four adults, among whom was a powerful male, and an individual of three-quarters growth. On the same day were seen a group of three others of the same species, and these include nearly all the animals of this species remaining in the region, within one or two; it is supposed that the number is not more than ten in all. It is thought that a few specimens exist also in the chain of Ubombo, but this appears doubtful, these being rather the *R. bicornis*. The white rhinoceros is protected as strictly as possible, and it is forbidden to hunt them under a penalty of $250 to $500, or imprisonment; the governor himself cannot give permission to kill them. It seems likely that the species will before long become extinct.

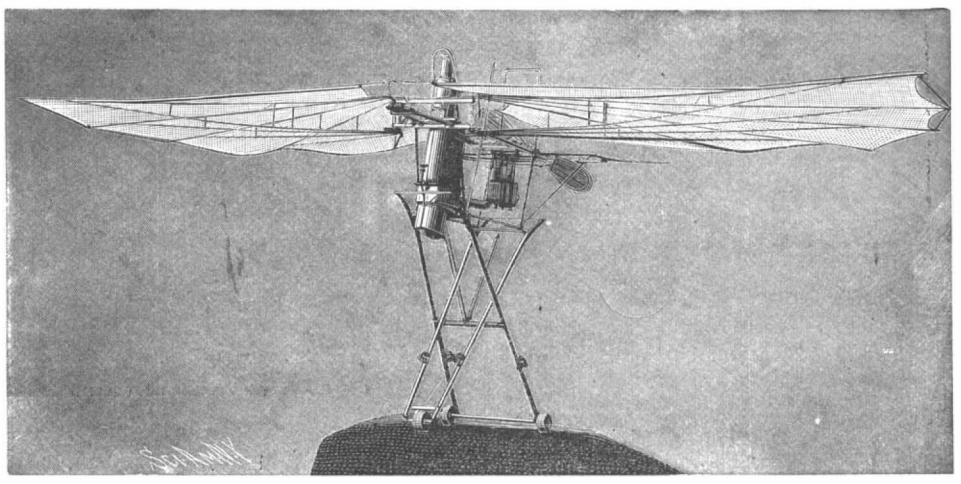

Fig. 2.—READY TO START.

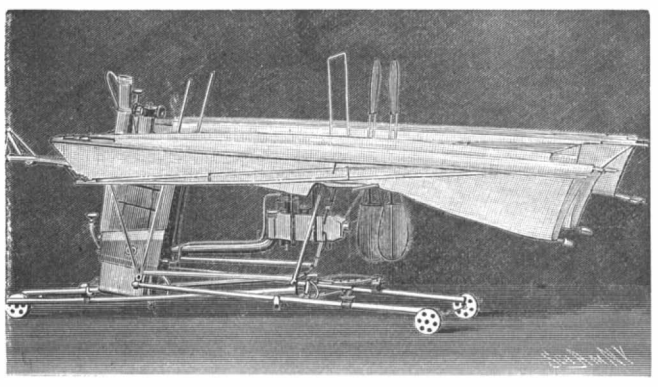

Fig. 1.—POSITION OF THE WINGS WHEN FOLDED.

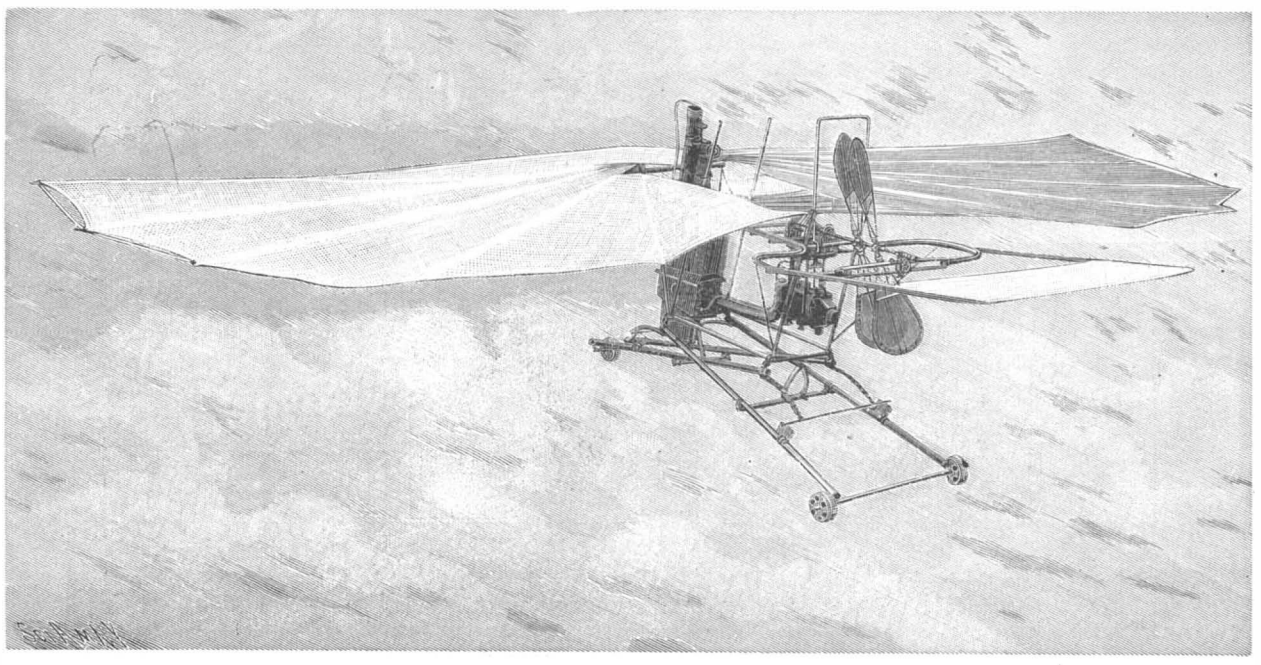

Fig. 3.—THE HOFMAN FLYING-MACHINE IN FLIGHT.

The Quagga.

The Zoologist contains an interesting account of the quagga and its disappearance, by Mr. Graham Renshaw. The quagga is now entirely exterminated, owing to its wholesale destruction by the hunters and colonists in South Africa. The blaubok has long since disappeared, and the blesbok nearly so; among other animals which are fast disappearing are the gnu, the white rhinoceros, the southern giraffe and the quagga. The latter was in former times very abundant at the Cape and in Orange Free State, and it wandered in these regions in herds of considerable size; at present, however, not a single one is found. This animal had almost the form of a horse, as regards the mane, tail, hoofs and general proportions. Its color was red-brown, passing to a tan color at the rear, then to white on the legs, tail and abdomen. The head was striped like that of a zebra, and the neck had large stripes of dark brown and white. The quagga when captured young was easily domesticated, and it could be crossed with the horse. It could be hitched to a vehicle, and in the first half of the century some of these animals have been seen drawing carriages in Hyde Park. The species has disappeared in the course of the present century; a hundred years ago it was still very abundant, although in 1820 it had already abandoned the district of Albany at the Cape. W. C. Harris, in 1836, explored the South African region and found the quagga in abundance in the plains to the south of the Vaal; to the north it was replaced by the zebra. The different quadrupeds were quite numerous, including, besides the quagga, the gnu, the blesbok, and others. It is especially after 1850 that the quagga began to diminish in number. The Boer hunters commenced to make their appearance and killed the quagga for its hide; there was no restriction laid upon the hunting of this animal, and after a number of years it began to be killed off; in 1865 it had disappeared from the Cape, and a few years later from Orange Free State. At the present time it has entirely disappeared and it is only in a few museums that stuffed specimens are to be seen.

Among the museums possessing skins or skeletons may be mentioned those of London, Edinburgh, Philadelphia, Paris, Amsterdam, Berne, Vienna, etc., the total being twelve or fifteen skeletons and skins. This is all that remains to represent a species which was once counted by thousands.

Compromise of an Important Patent Suit.

Suits for infringement of patents instituted more than five years ago by the American Nickel Steel Company, of Philadelphia, against the Carnegie Steel Company and the United States government were compromised at Washington on April 23. The amount paid by the defendants is not known. It is said that the sum paid amounted to about 5 cents a pound for armor plate in which nickel steel was used. It is also said that suits will now be brought against other manufacturers who use nickel steel in any form. The American Nickel Steel Company grants to the government and the Carnegie Steel Company a license to use the patents of that company in all nickel armor plate manufactured by them.

There are about forty steamers whose sole work is the laying and maintenance of the telegraph cables of the world.

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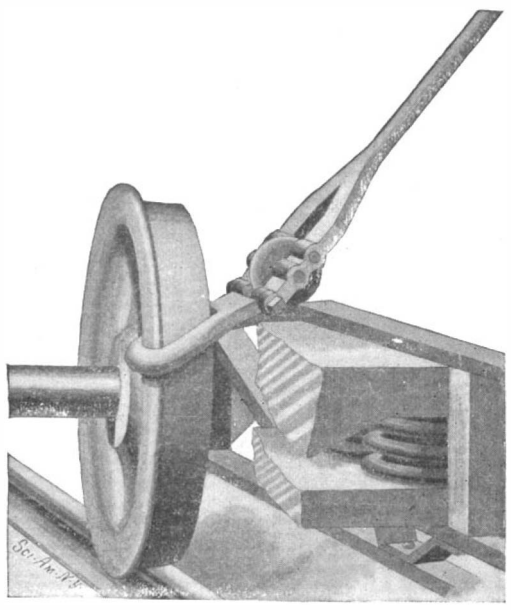
A SIMPLE CAR MOVER.

When a car is to be moved a short distance and it is not convenient to use a locomotive, special hand devices are used. A simple, highly efficient device of this kind has been invented by Samuel E. Kurtz, of Sac City, Iowa.

As our illustration shows, the car-mover comprises a lever in which a fulcrum-roller is adjustably held and with which a swinging grip-hook is connected.



KURTZ'S CAR-MOVER.

A knife-edge on the grip-hook serves to grip the car-wheel when the lever is operated.

With the fulcrum-roller bearing on the truck-frame, powerful pressure can be brought to bear to turn the wheel. The roller moves toward or from the end of the lever to change the leverage power.

The device applies its power in the direct course of the revolution of the wheel, and every pound applied is utilized. Its construction is simple and durable. Its weight is but 20 pounds.

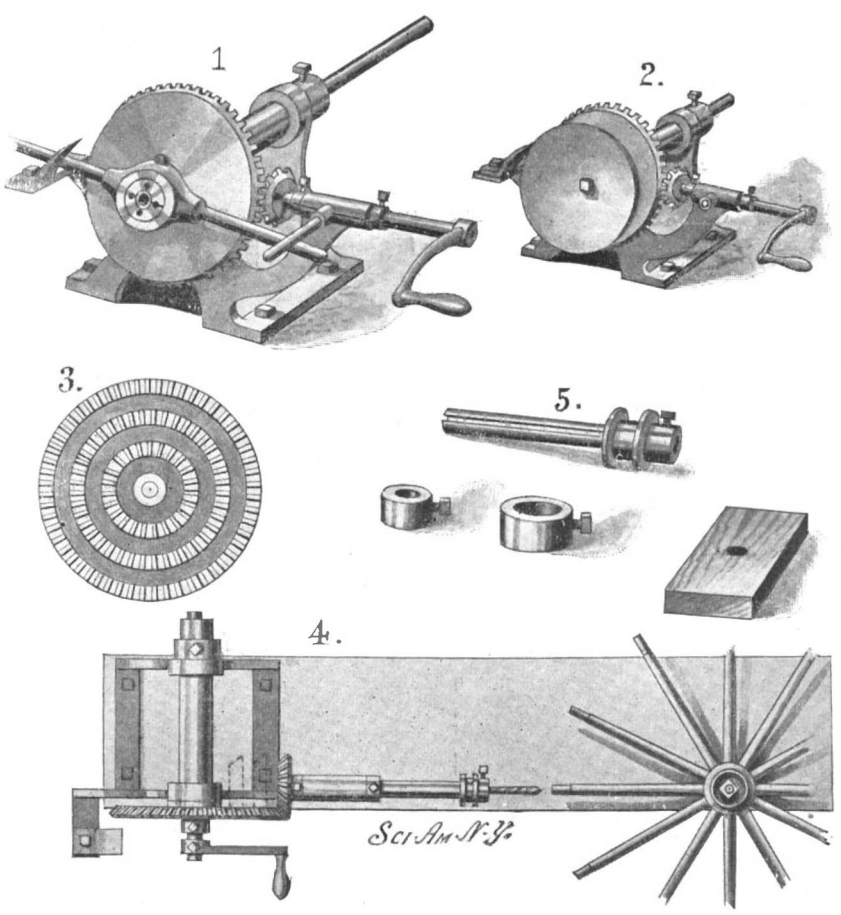
COMBINATION METAL AND WOOD-WORKING MACHINE.

An ingenious and inexpensive combination metal and wood-working machine has been invented by G. W. Hoadley, of Garden Grove, Iowa, which machine fills the want for some portable device by which threads can be cut on large rods or pipe. Any screw plate can be used; for no dies are required. It is one of the main features of the device that the rod or pipe and not the thread-cutting tool revolves. The machine can be used for boring metal or wood, sharpening disks or tenoning spokes.

On a bed a headstock is carried, having a bearing for a hollow shaft carrying on its inner end an adjustable pinion which is adapted to mesh with one of a number of bevel gear wheels arranged concentrically on the inner face of a multiple gear wheel (Fig. 3). The multiple gear is transversely journaled in the headstock. Collars on opposite sides of its bearing hold the hollow shaft in position but permit its longitudinal adjustment to bring the pinion in mesh with any of the bevel gears on the multiple gear. To permit this adjustment the multiple gear can be shifted outwardly. A setscrew on the outer end of the hub of the multiple gear secures a pipe or other article to be threaded and causes the pipe to rotate with the gear wheel, when a crank on the end of the hollow shaft is turned. In threading smaller pipes or rods, a collar having a setscrew is secured in the hub of the multiple gear and the pipe is secured in the collar by the setscrew. The thread-cutter is of any approved type and is provided on its stock with handles to start the thread by hand. Sockets in the cutter stock receive long handles which rest on bars or arms (Fig. 1). Thus in threading a pipe, the cutter is held rigidly in place, while the pipe is turned with the multiple gear by the rotation of the crank on the hollow shaft. If it be desired to sharpen a harrow disk, a sharpening tool carried on one of the bars of the head-stock is used. The harrow disk is mounted on the squared end of a rod secured in the hub of the multiple gear, so that the disk is rotated with the multiple gear and the disk-edge sharpened (Fig. 2).

When it is desired to use the machine in boring holes in wood or metal, or in forming tenons on spokes, as shown in Fig. 4, then the crank-arm is removed from the hollow shaft and placed on a rod or pipe secured in the hub of the multiple gear, and the end of the hollow shaft is fitted with a boring tool. Upon turning the crank-arm secured to the multiple gear, the hollow shaft and the tool will be turned. In order to feed the tool into the wood, the wheel or other work is carried on a slide, spring-pressed into engagement with the tool.

In a shop the gearing can be permanently mounted on a bench if it be so desired, but the construction is so simple that the operative mechanism can be readily removed. The gearing can be bolted to the bottom of a pump wagon or to any convenient bed.



COMBINATION METAL AND WOOD-WORKING MACHINE.

Manufacture of Cocoanut Butter in Mannheim.

The manufacture of cocoanut butter is an industry of some importance in Mannheim. This factory is said to be the only one of any considerable size in Germany. It has an output of about 10 tons of butter per day. The business was started in 1886, and, the proprietors say, shows a steady increase. The product is sold under the name of "Palmin"—a registered trade name—or cocoanut butter (German, "Kokosnussbutter"). It is manufactured from the kernels of cocoanuts and is used as a substitute for butter and lard in cooking. As sold, it is generally white in color, almost tasteless, melts at about 80° F., and is of about the consistency of mutton or beef tallow. When desired by consumers, as bakers, confectioners, etc., the product is colored to resemble ordinary butter. When furnished to dealers, it is unlawful to color it. The proprietors claim an analysis of their product shows it to contain more than 99 per cent of vegetable fat, with but a slight trace of water, while ordinary butter contains about 85 per cent of fat and nearly 15 per cent of water. It is stated that the substance does not become rancid easily, that it will keep for three or four months in a cool room, and that it is much more wholesome and easily digested than the ordinary fats used for baking and cooking. For this reason the product has met with considerable favor in German hospitals and other institutions, and for use in army camps.

Cocoanut butter is generally put up in square packages wrapped in parchment paper, a small percentage being sold in tin cans. The latter are hermetically sealed for shipment during hot weather. The product is sold at one price throughout Germany, namely, about 16 cents per pound, or about half the price of ordinary butter. It is handled in somewhat limited quantities by about fifty grocers in Mannheim.

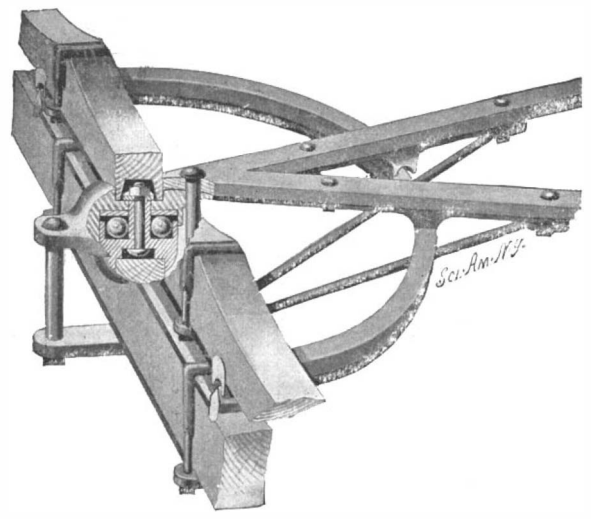
The processes of manufacture are, for the most part, secret, and, it is claimed, are protected by patents. The kernel of the cocoanut is imported in thoroughly dried strips, forming the "copra" of commerce. It is subjected to various refining processes by which all the free acids and other substances are separated, leaving only the vegetable fat. In the latter stages of the manufacture the product resembles ordinary butter recently churned. It is placed in machines similar to the separators used in creameries, in which the water and other foreign substances are separated by centrifugal force. In the manufacture of cocoanut butter a by-product, consisting of free acids and other substances, is obtained and sold to soap manufacturers.

A very bright comet was discovered by Halls at Queenstown April 23. It was observed at Cape Town by Gill April 24.

A NOVEL FIFTH-WHEEL.

A wagon and carriage fifth-wheel which has a central ball-bearing and interlocking strain-relieving segmental braces forming a portion of the bearing is a recent-patented novelty, invented by Christopher G. Burdick, of Antigo, Wis.

The central ball-bearing in question comprises two cups, one arranged to enter the other. One cup has a hollow post which passes through an aperture in the opposing cup; and through the hollow post a king-bolt extends, which is provided with a washer having bearing against the cup through which the bolt is passed. Within the cups around the post balls are placed.



THE BURDICK FIFTH-WHEEL FOR WAGONS AND CARRIAGES.

Extending rearwardly from the cups are segmental guards or braces, the under face of one guard having a half-round groove and the upper face of the opposing being triangular in cross-section. The two guards or braces are normally held out of contact with each other.

Should the weight be greater on one side than on the other or should the vehicle be cramped at any time, the braces or guards will be brought together in such relation that they will sustain the greater portion of the unevenly-distributed weight and will therefore prevent the ball-bearing of the fifth-wheel from being subjected to extra friction or from being cramped or locked.

The construction of the fifth-wheel is furthermore such that the main king-bolt is concealed and protected. Auxiliary king-bolts located at front and rear of the main king-bolt act in conjunction with the braces or guards to overcome the severe strain which the main king-bolt would otherwise be called upon to sustain.

Under date of February 23, 1901, Consul-General Guenther, of Frankfort, says it is reported that the Russian government, in order to facilitate the telegraphic business between Odessa and Berlin, will construct a direct line between these two cities. Work on the new line will be commenced in the spring.

The Current Supplement.

The current SUPPLEMENT, No. 1322, has many interesting and valuable articles. "How Art Is Applied to Industrial Training in Philadelphia" is by J. A. Stewart and is accompanied by a number of engravings made from photographs taken especially for the SUPPLEMENT. "Screw Barges" describes a new system in use in England. "Induction Coils and Interrupters" is accompanied by three engravings. "High Potential Phenomena" is by A. P. Carman. "Military Bridges" illustrates some interesting portable bridges, or bridges which can be constructed at short notice. "European and Asiatic Faunas and Their Relations Past and Present to that of Africa" is by Prof. H. Pilsbry. "A General Survey of Foreign Trade" is concluded in this issue and is accompanied by two maps showing the entire world and where the United States manufactured goods are sold.

Contents.

(Illustrated articles are marked with an asterisk.)

Baldwin-Ziegler expedition	275	Meteorites, composition of	278
Bridge Bill, North River	274	Moore, Edward B.*	527
"Celtic," launch of the*	276	Nile, irrigation works*	273, 279
Clock, perpetual motion*	276	Nitro-cellulose	274
Cocoanut butter	282	Patent suit, compromise of	281
Commissioner of Patents, Asst*	275	Quagga	281
Exposition, Pan-American	275	Rhinoceros, white	281
Fifth-wheel	282	Siberia in the glacial age	280
Flying Machine, Hoffman's*	281	Smithsonian report	274
Heavens in May	279	Submarine boat, Turkish*	280
Inventions recently patented	283	Telegraph, page-printing*	277
Machine, metal and wood*	282	Wine production, French	277

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

MACHINE FOR TOPPING BEETS.—JULIUS H. LUHRS, Fruita, Col. This machine for topping beets is so constructed that the cutters will remove the same amount of crown from the beets, whether the crowns be just above the surface of the ground or extend some distance above the surface. The machine is light and strong and is provided with means whereby the cutting section will automatically adjust itself to the exposed portions of the beets in its path, so that the crowns will be cut at a uniform depth.

Engineering Improvements.

STEAM-BOILER.—CHARLES EDGERTON, Fidelity Building, Philadelphia, Pa. Above the crown-sheet of this upright tubular boiler a receptacle is placed for catching and retaining scale, the receptacle being of less diameter than the shell of the boiler. All the tubes pass through this receptacle so closely that no water-circulating opening is provided. A handhole and cover are arranged within the shell of the boiler at or near the level of the receptacle. Upturned edges of the receptacle prevent the discharge of the scale over the edges into the water-leg. The upward circulation is confined entirely to the annular space surrounding the pan, which insures the precipitation of the sedimentary matter toward the center. By reason of this construction the crown-sheet of the vertical tubular boiler is rendered more durable.

Mechanical Devices.

COUNTERBALANCE. — ROBERT E. FORD, Pasadena, Cal. The invention relates to machines having reciprocating and revolving parts, especially such machines in which reciprocating is to be converted into rotary motion, or *vice versa*. The principal feature of the invention consists in counterbalancing both the horizontal and vertical forces of the machine by the use of a number of counterbalancing bodies, arranged to move in unison, to counterbalance one another in a vertical direction, and to revolve in unison with the revolving parts of the machine. The bodies have an aggregate mass and center-of-gravity radius such that the product shall be equal to the product of the mass of the reciprocating parts and the crank radius.

PROPELLING VESSELS.—JOHN G. PINKERT, Hamburg, Germany. A new and improved motor has been devised by the inventor, operated by the explosion of combustible material for the propulsion of all kinds of vessels. In this motor the gaseous products of combustion are made to act directly upon the water or other medium to drive the vessel forward by reaction without any other propelling means. The motor has a working-cylinder open at one end in order to allow the explosion gases to act on the medium through which the vessel is traveling. A piston is moved within the cylinder. Mechanism controlled by the piston admits propelling charges to the cylinder.

DEVICE FOR OPERATING THEATRICAL SCENERY.—RICHARD HYDE, Brooklyn, New York city. The main purpose of the invention is to obviate the difficulty experienced in adjusting scenery when operated by ropes and pulleys—a difficulty caused by the expansion and contraction of the separate hanging ropes. In the present invention only the expansion or contraction of a central rope need be considered. By this arrangement scenes can be adjusted by pulling down one corner of the scene itself, the other corner going up correspondingly. The invention further provides a snap-catch for the pulley-block with which all the ropes are connected. The scenery can be lowered without the use of a counterweight.

MAGAZINE-PISTOL. — WALTER J. TURNBULL, New Orleans, La. By means of the construction provided by this inventor the cartridges are fed accurately by the same device which operates the hammer. The device also effects a positive lock for the feed mechanism, just before and during the time the hammer acts upon a cartridge. A portion of this hammer-operating mechanism is always in engagement and in controlling contact with the feed mechanism.

Railway Appliances.

PNEUMATIC PACKAGE-HOLDER.—GEORGE H. WALL, Cadillac, Mich. The invention is a drop-platform for railway-cars and other vehicles employed to carry freight parcels, mail matter, and the like. The platform can be raised and locked, but is free to drop when released by the locking device, either by its own weight or by the weight of material placed thereon. The means employed for raising the platform permit the handling of a heavy load. The devices for raising the platform are pneumatic and operate with the least possible friction.

Miscellaneous Inventions.

JUNCTION-BOX. — GEORGE L. HOLSHUH, Brooklyn, New York city. The invention is an improvement in junction-boxes for electric wiring in buildings and provides a ceiling junction-box with a simple device for locking it to a gas-pipe, the device being conveniently operated by a tool inserted through an opening in the lower side of the box.

HARNESS ATTACHMENT. — ORANGE A. DEAN and CHARLES H. ADREAN, Toulon, Ill. The attachment is designed to hold a checkrein in engagement with the gig-saddle and to hold the pad in place. The gig-saddle is provided with a check-hook. Under the gig-saddle a flexible strap lies, comprising a shank provided at one end with a loop capable of being bent upward to receive the checkrein and at the other end with an eye capable of being bent upward to engage the back-strap.

CUSPIDOR.—JOHN C. BLAIR, 40 Chestnut Street Louisville, Ky. A water-pipe is arranged within the cuspidor and is passed centrally through a disk. A flanged spreader is connected with the pipe and has lateral orifices opening below the flange and above the disk. A central screw-valve is arranged in the spreader, its head being accessible at the top of the spreader. The sanitary merits of this arrangement need no comment.

STEAM AND HEAT CONSERVATOR.—BARDEN W. TAYLOR, Manhattan, New York city. One object of the invention is to condense the exhaust-steam and utilize its heat for reheating and superheating the water of condensation and for heating air to be used in the firebox. Still another object of the invention is to purify the water of condensation and form feed-water free from all foreign matter, liable to produce scale in the boiler.

METHOD OF TREATMENT OF AMALGAM CONTAINING COPPER OR PRECIOUS METALS.—JOACHIM H. BURFEIND, Salt Lake City, Utah. The method of treating amalgams which forms the subject of this invention consists in adding sulfur to the amalgam at a temperature not exceeding the boiling-point of water and separating from the amalgam the copper sulfid formed.

THEATRICAL DEVICE. — SAMUEL W. COMBS, Manhattan, New York city. The purpose of the invention is to provide a stage effect in which water apparently rises gradually to a certain level on the stage, but without wetting the stage. A glass tank is employed which is used in connection with a tarpaulin or waterproof cloth to produce the illusion that the stage is being gradually covered with water. These tanks are so placed upon the stage that the sides toward the audience being transparent, cannot be seen, the horizon lines being properly concealed by stage fittings or settings of any kind. Any action that may take place behind the tanks will be quite apparent in front.

GAGE.—ARTHUR J. LUCY, Meadowcraft, Penn Road, Croydon, Surrey, England. The gage is a workshop instrument for marking off and setting out centers, the teeth of wheels, and the like, gaging and testing bevels, setting and adjusting tools. The instrument consists of a stock, a sector circularly adjustable in the plane of the stock and designed to act as a carrier for a rule slidably fitted therein, which by the circular adjustment of the sector can be brought into any desired angular relation to the base or other datum edge of the stock. The sector and stock are provided with scales whereon this angular relation may be read off.

HITCHING DEVICE.—PARKER M. BRAGUNIER, Denver, Colo. The hitching device for the driving reins of harness is to be attached to the cross-bar of vehicle-shafts. The single or double trees are constructed in pivotally-connected sections, so that when a driving-rein is secured to the hitching device, and the sections of the single or double tree are free to move forward at their outer ends, the traces will be slackened and the draft of the vehicle will be through the reins, thus tending to check the animal should he endeavor to run away.

METAL CEILING.—FREDERICK H. S. HAWLEY, Pretoria, South African Republic. The invention so simplifies and cheapens the work of erecting metal ceilings that the plates or panels can be quickly and systematically laid upon a foundation consisting of two series of furring strips, one series being at angles to the other series and the upper series resting upon the upper surfaces of the furring strips of the lower series. Thus, it is no longer necessary to recess and interlock the strips.

DOG-MUZZLE.—WILLIAM MCMANUS and CHARLES N. DILATUSH, Hagerman, Idaho. The dog-muzzle has a body, the front part of which is extended forwardly under the mouth of the dog to prevent the dog's taking food. The body is held in position by a strap which passes over the head and is fastened to a neck-strap. The device is particularly intended for use on sheep dogs in the West, in which districts the sheep ranges are poisoned to exterminate coyotes.

Designs.

BELT.—LOUIS SANDERS, Brooklyn, New York city. The leading feature of the design is to be found in diverging points extending above and below the longitudinal edges of the body section of the belt at the back, producing a bodice effect at the rear central portion of the belt.

BUTTON.—MOSES B. SHANTZ, Rochester, N. Y. The obverse of the button has a spherical center with connected apertures and is surrounded by a circular rim arched in cross section to form at its inner edge a circular joint. The outer portion of the rim is rounded off to the reverse of the button. At its middle portion this reverse is convex and is slightly dished to the rounded edge of the rim.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send your name and address to the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 505.—For small rotary pumps for moving the circulating water in gas engines.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 506.—For lightning rod fixtures.

Motor Vehicles, Duryea Power Co., Reading, Penn.

Inquiry No. 507.—For parties to make special needles from drawings, etc.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 508.—For information as to photographic paper-coating machinery.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inquiry No. 509.—For manufacturers of a machine for printing, developing, fixing and washing bromide paper from a continuous roll of paper.

La Porte Watch School, La Porte Ind. Catalogue free.

Inquiry No. 510.—For a device for burning garbage in private houses.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 511.—For spring motor fans.

Dies & Special Machinery. Amer. Hdw. Mfg. Co., Ottawa, Ill.

Inquiry No. 512.—For manufacturers of feather renovating machines.

Machine chain of all kinds. A. H. Bliss & Co. North Attleboro, Mass.

Inquiry No. 513.—For manufacturers of soft Swedish iron for making small magnets.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 514.—For second-hand machinery dealers handling a 9-inch acrew cutting, foot power lathe.

Sheet Metal Stamping: difficult forms a specialty. The Crosby Company, Buffalo, N. Y.

Inquiry No. 515.—For set of castings 1 h. p. marine gasoline engine.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 15, Montpelier, Vt.

Inquiry No. 516.—For manufacturers of seamless tubing having inside diameters from 4-16 to 6-16 inch, nesting and closely fitting the next size larger.

Our number 4 Catalogue of Automobile parts, write us, Standard Welding Co., Cleveland Ohio.

Inquiry No. 517.—For machinery for drying fruits and vegetables.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 518.—For a filter to filter and clarify vegetable oils.

SAWMILLS.—Variable friction feed. Send for Catalogue B. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 519.—For manufacturers of the Serpollet boiler.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 520.—For a machine for making ice in small quantities adapted for hotel and family use.

Machinery designed and constructed. Gear cutting. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 521.—For manufacturers of springs similar to clock springs 50 or 60 feet long, 1¼ inch wide by 45 minums thick.

For sale and introduction in Scandinavia, of American goods, any and all. Apply to O. P. Jespersen and Sonner, Copenhagen, Denmark.

Inquiry No. 522.—For dealers in ornamental baskets made by Indians in Canada.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 523.—For machine for carding hair for mattresses.

The best book for electricians and beginners in electricity is "Experimental Science." by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 524.—For parties to make a combination watch charm and match lighter.

Sheet Metal Novelties. Articles and Stampings of all sizes. Tools and dies manufactured on contract. Address Standard Stamping Co. Cor. 7th & Hudson Sts., Buffalo, N. Y. U. S. A.

Inquiry No. 525.—For manufacturers of typewriter ribbons before they are inked.

FOR SALE.—Patent of Saw-Mitering Device, a combination folding tool. Bisects all angles automatically. Miters plain, circular, segmental and radial work. James Lumsden, P. O. Box 72, North Tarrytown, N. Y.

Inquiry No. 526.—For manufacturers of the oscillating steam engines or castings of them.

Moistener and Sealer. For moistening and sealing stamps, Envelopes and Labels. Patents for sale or on royalty. Excellent chance for manufacturer with facilities for introducing a useful device. Address, CHAS. L. VOSE, Westerly, R. I.

Inquiry No. 527.—For manufacturers of Monarch wire cutters.

WANTED.—An experienced specification writer and patent expert having a thorough knowledge of the patent practice and preferably one competent to handle electrical cases. Munn & Co., Solicitors, Office of SCIENTIFIC AMERICAN, 361 Broadway, New York.

Inquiry No. 528.—For the makers of the "Becker routing machine."

HELP WANTED.—By a manufacturer in Central New York, a thoroughly competent man to take charge of woodworking department, running on hard and soft wood parts for agricultural machinery. Must have had practical experience with modern machinery and in the handling of a large number of men. State experience, age and give reference. Address Foreman, P. O. Box 773, N. Y.

Inquiry No. 529.—For manufacturers of small nails or hooks such as are driven into kegs to keep the hoops on, and are short enough to not reach through the wood.

HELP WANTED.—By a manufacturer in Central New York, a competent man to take charge of pattern Department, making both wood and metal patterns. A A man who has had charge of metal pattern work for malleable iron foundries and who understands the economical finishing and gating of patterns preferred, Give age, experience and references. Address Pattern Maker, P. O. Box 773, N. Y.

Patent for Sale.—American rights to patented pocket warmer. A pronounced success in England. Strongly recommended by the medical profession. Easy to manufacture. Sell on sight. Profit large. W. H. Thomassen, 417 W. 22d St., New York.

Inquiry No. 530.—For information as to the process of lead burning.

Inquiry No. 531.—For manufacturers and dealers in foot power machinery, such as used by lapidarists.

Inquiry No. 532.—For manufacturers of cork-making machinery to be operated by power.

Inquiry No. 533.—For manufacturers to make small stampings.

Inquiry No. 534.—For the manufacturers of "Hawk Brand tool steel."

Inquiry No. 535.—For dealers in Crookes bulbs.

Inquiry No. 536.—For a mechanical digger or plow in combination with a traction engine to be used in wheat sowing.

Inquiry No. 537.—For good and cheap wind engines.

Inquiry No. 538.—For manufacturers of paper fiber suitable for trunks.

Inquiry No. 539.—For manufacturers of stills for the distillation of water on a commercial basis.

Inquiry No. 540.—For manufacturers of trunks and bags and tools for the making of the same.

Inquiry No. 541.—For manufacturers of trunk and bag trimmings, hinges, locks, covering, etc.

Inquiry No. 542.—For dealers in or parties to make a seamless bag such as is used by salt and sugar works.

Inquiry No. 543.—For manufacturers of lime burners to burn a substance in a powdered form.

Inquiry No. 544.—For manufacturers of milk pails.

Inquiry No. 545.—For manufacturers of novelties.

Inquiry No. 546.—For summer resort attraction such as "Shoot the Chute," "Steeplechase," "Dante's Inferno," Merry-go-rounds," etc.

Inquiry No. 547.—For a water fountain and figure for a New York village.

Inquiry No. 548.—For machine for engraving monograms and initials on glass or chinaware, not by grinding.

Inquiry No. 549.—For a process for treating iron castings to prevent rusting; not galvanizing or plating.

Inquiry No. 550.—For machinery for alluvial placer work; also for underground gold-extracting machinery.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8172) L. W. says: 1. If heat under pressure enveloped a boiler, the temperature being maintained, would its steaming power be increased, and if so what is the proportion of the pressure to the heating power? A. Yes. The heat would be imparted to the boiler if its temperature should be greater than the temperature of the boiler. The pressure depends upon the kind of material used to convey the heat. 2. What is the proportion of the increase in volume of air under increased temperature? A. Air expands by heat in the ratio of the absolute temperature. The absolute temperature below zero Fahr. is 460°, to which add the higher temperature and divide by the initial temperature, plus 460°. Thus the absolute temperature of 50° is 510°, and if the air is heated to 200° the absolute temperature will be 660°, and 660/510 = 1.294 the new volume. 3. Could hot, or expanded, air be practically employed as a motive power? A. Air expanded by heat is used as a motive power in hot-air engines. 4. What is the temperature about of a briskly burning hard coal fire? A. Temperature of a strong coal fire is from 2,000° to 2,500° Fahr. 5. What is the greatest temperature obtainable from the flame of a kerosene lamp? A. Temperature of a kerosene lamp is from 1,600° to 1,800° Fahr.

(8173) C. C. S. asks: How is it possible for the different phonograph companies to make such loud records? I have experimented with all kinds of machines, but cannot make one anywhere near as loud as I can buy. I think electricity is used to record the sound waves. A. It is not at all strange that a man whose trade it is to make records can make louder ones than an amateur can. We are not informed as to the secret process employed by different companies to make better records than their competitors.

(8174) J. H. White writes: I have seen an account of a supposed suck-hole in a certain creek in Kentucky, which upon investigation proved to be a huge lodestone, about fifty yards long and six inches wide, from which men were rescued with difficulty while swimming, and which held dogs with such power that they never came up. If this is true, is it not a manifestation of a force radically different from electro-magnetism? Can you explain the phenomenon? Will you please inform me where I can purchase a lodestone? A. If this is true, it is indeed unlike anything hitherto known on earth. No lodestone ever had any power to attract the human or canine

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body. We cannot offer any suggestion in explanation till the report is found to be true. Lodestone is an ore of iron which exists in great quantities in our country, and can be bought of any dealer in specimens of minerals. You can find plenty of specimens at the university in your city.

(8175) J. H. Tripp asks: What is meant by "weight per mile ohm"? We find this expression repeatedly used in wire catalogues, as: Weight per mile per ohm, 5,500 to 5,800 pounds. A. That a wire one mile long and having a resistance of one ohm would have the weight given.

(8176) W. M. M. writes: I claim that the direction of armature of a multiple-connected motor cannot be changed by simply reversing the direction of current through the armature; but direction of armature can be changed only by reversing direction of current through the field. A. The direction of rotation of an armature is reversed by reversing the current through either the field or armature, but not through both.

(8177) C. T. P. asks: 1. What are "electric gases" in connection with boiler explosions? A. If gases from the decomposition of water accumulated in a steam boiler, they might be called "electrical gases." We have no personal knowledge of the formation of any such gases. 2. Is it dangerous to ground a telephone wire on a pipe running to a steam boiler? A. We can see no reason why it should be. 3. Would it be dangerous to put copper rivets or copper pipe connections on a boiler or on a digester for boiling fats with lime under 120 pounds pressure? A. There are in some fats acids which will act upon copper and form compounds at the expense of the copper. Thus the tube would be eaten away and in time become weak. It might then burst from the excess of pressure above what it could stand. 4. Would the copper against iron form electricity and dangerous "electric gases"? We have academic information that they will, but have been unable to find any practical engineer who will concede that there is anything in it. A. We do not apprehend anything of the kind is likely to happen.

(8178) O. P. McK. asks: Is there such a thing as electro-plating copper plates with a steel plating, or is there any plating for copper that it harder than copper itself? A. The operation called "steeling" is really coating a softer metal with iron. There are several metals harder than copper which can be deposited upon a surface of copper. The processes are given in Langbein's "Electro-Deposition of Metals," price $4 by mail, a full and reliable treatise on the subject.

(8179) W. M. D. asks: 1. What is the cost of magnetizing steel blocks 1 x ⅛ inch, and how long will they keep their strength? A. Steel magnets are best made by sending a current of electricity around them. Make a coil of wire large enough to pass the bars through and connect to a battery. Pass the bar to and fro several times through the coil. If properly taken care of, the magnetism will be retained. See Scientific American, Vol. LX., No. 16, price ten cents by mail. 2. Is there any way to register daylight? A. There are several forms of sunshine recorder in use. Any of these will give the time during which the sun has shone while it has been exposed. See Scientific American Supplement, Nos. 277, 336, 369, 554, 662, 1156, price ten cents each, for illustrated descriptions of these instruments.

(8180) J. G. Von H. asks: 1. How large a spark from a spark coil is it necessary to have to excite a wire, say 1,000 feet away, with the Hertzian wave as used in wireless telegraphy? A. A Ruhmkorff coil is required for wireless telegraphy. While exact data are not at hand, it is probably near the truth that a spark coil giving a spark of one-half inch in length will transmit 1,000 feet. 2. Will a disruptive spark from a static machine excite a distant wire like the spark from a spark coil? A. A static machine may be used as a transmitter.

(8181) F. H. P. asks: Will you please state in the inquiry column directions for making an electrical heater? The system is the Edison three-wire, direct current, 110 volts at half ampere. A. If you wish but one-half an ampere to flow through your heater, it will not have much heating power. However, to make it, take about 625 feet of No. 26 iron wire and arrange it so that the turns do not touch each other. They must not touch anything which can be set on fire nor rest on any metal at any point. Asbestos is used to prevent the wire from coming in contact with the metal frame which must be used to support the wire.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

APRIL 23, 1901,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abrading machine, J. M. Nash..... 672,511
Accumulator battery, P. Marino..... 672,563
Amalgamator, L. Mayhew..... 672,739, 672,740
Amalgamator, Ghiglieri & Schofield..... 672,524
Antirattler and thill coupling, combined, E. Jarrell..... 672,775
Anvil, O. P. Wilcox..... 672,580
Automobile driving gear, P. Steinhauer..... 672,718
Axle fastening, C. Kuchenbrod..... 672,560
Axle spindle, wagon, H. Stockman..... 672,606
Back pedaling brake, C. O. Barnes..... 672,610
Bag. See Laundry bag.
Baling press, J. S. Tuttle, et al..... 672,687
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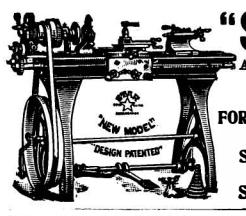
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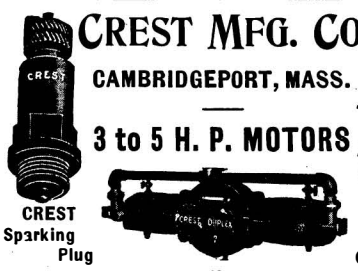
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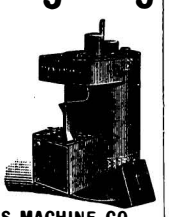
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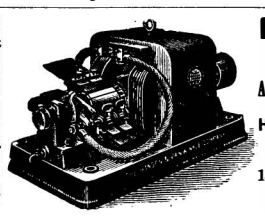
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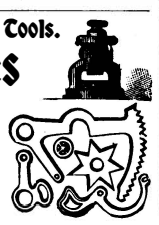
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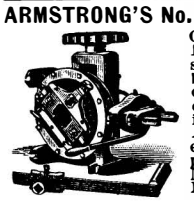
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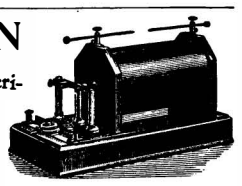
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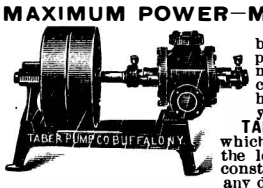
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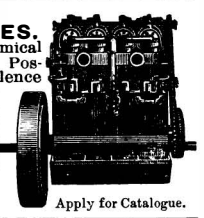
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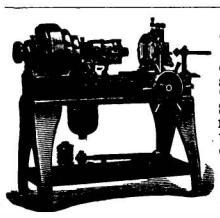
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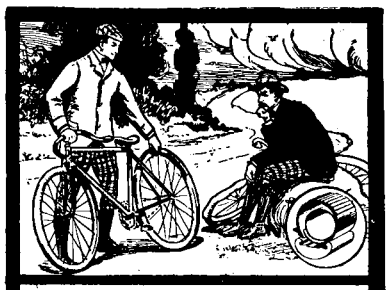

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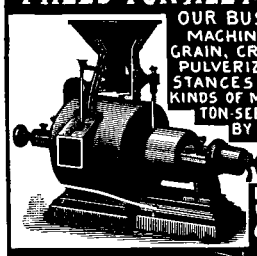

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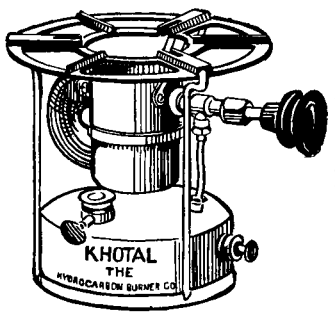

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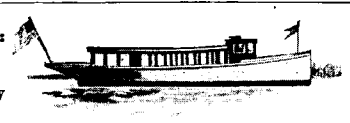

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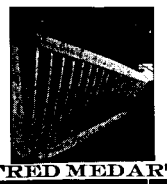

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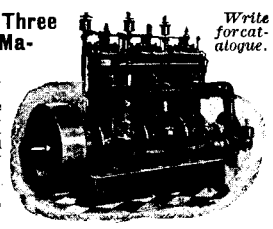

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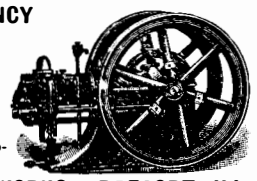

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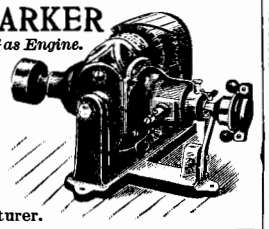

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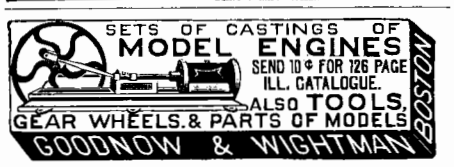

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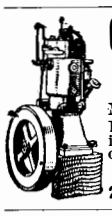

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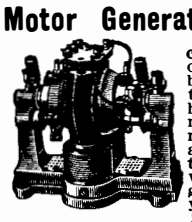

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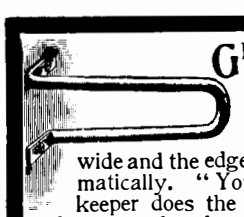

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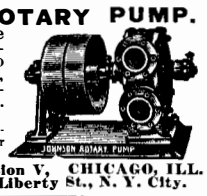

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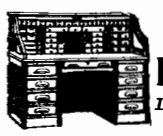

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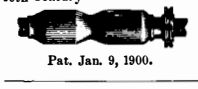

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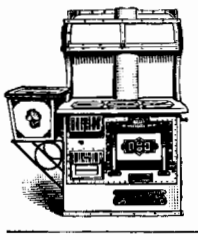

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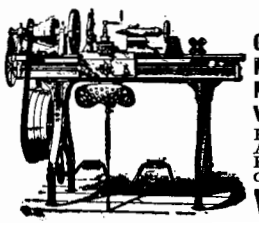

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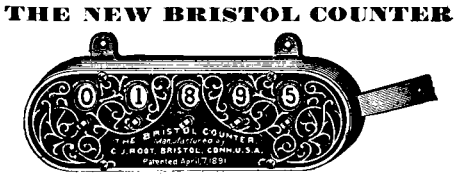

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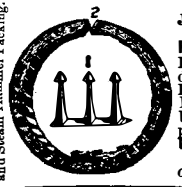

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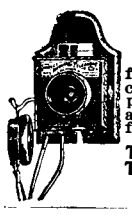

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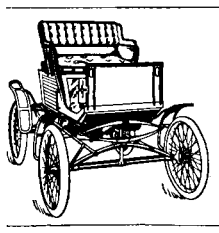

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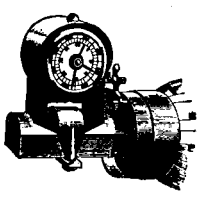

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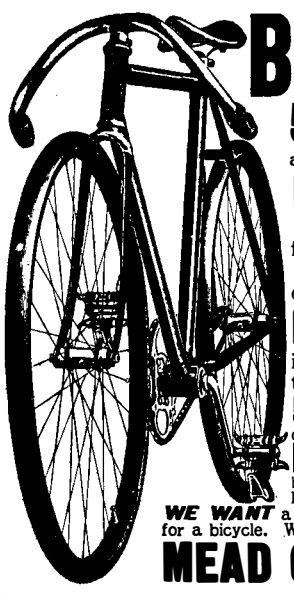

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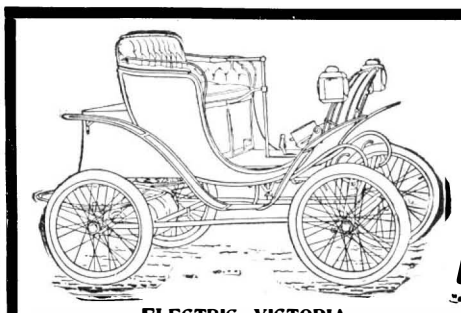

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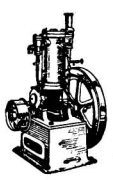

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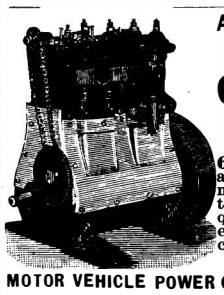

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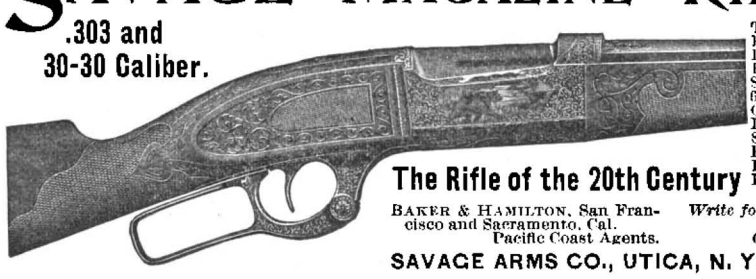

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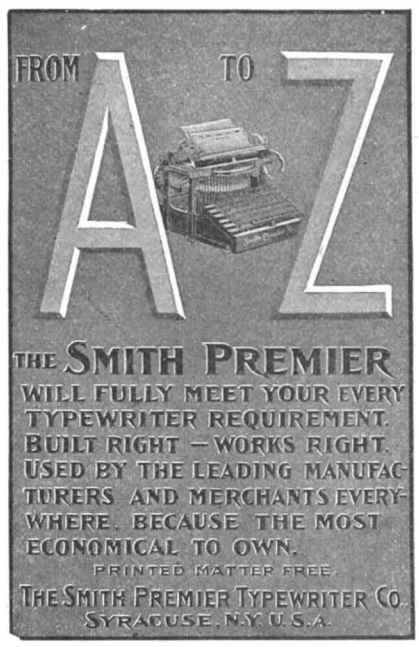
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